Symmes Hospital Redevelopment

Transportation Overview

Prepared for

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Introduction

This document provides a detailed transportation overview of the Symmes Hospital redevelopment in Arlington, Massachusetts, led by E.A. Fish Associates. The full build-out of the project will include up to 275 residential housing units and 40,000 square feet of medical outpatient office space. Parking for 626 vehicles will be provided in a mix of surface lots and garage spaces. This transportation study includes:

- Existing transportation conditions, including intersection capacities, parking, transit, pedestrian circulation, and site conditions;
- No-Build — a Year 2009 baseline scenario that presents traffic changes resulting from general background growth and additional vehicular traffic associated with other nearby projects (not including the Symmes redevelopment); and
- Build — a Year 2009 scenario in which the traffic volumes associated with the Symmes project
- are added to the No-Build Scenario and the transportation analysis is repeated.

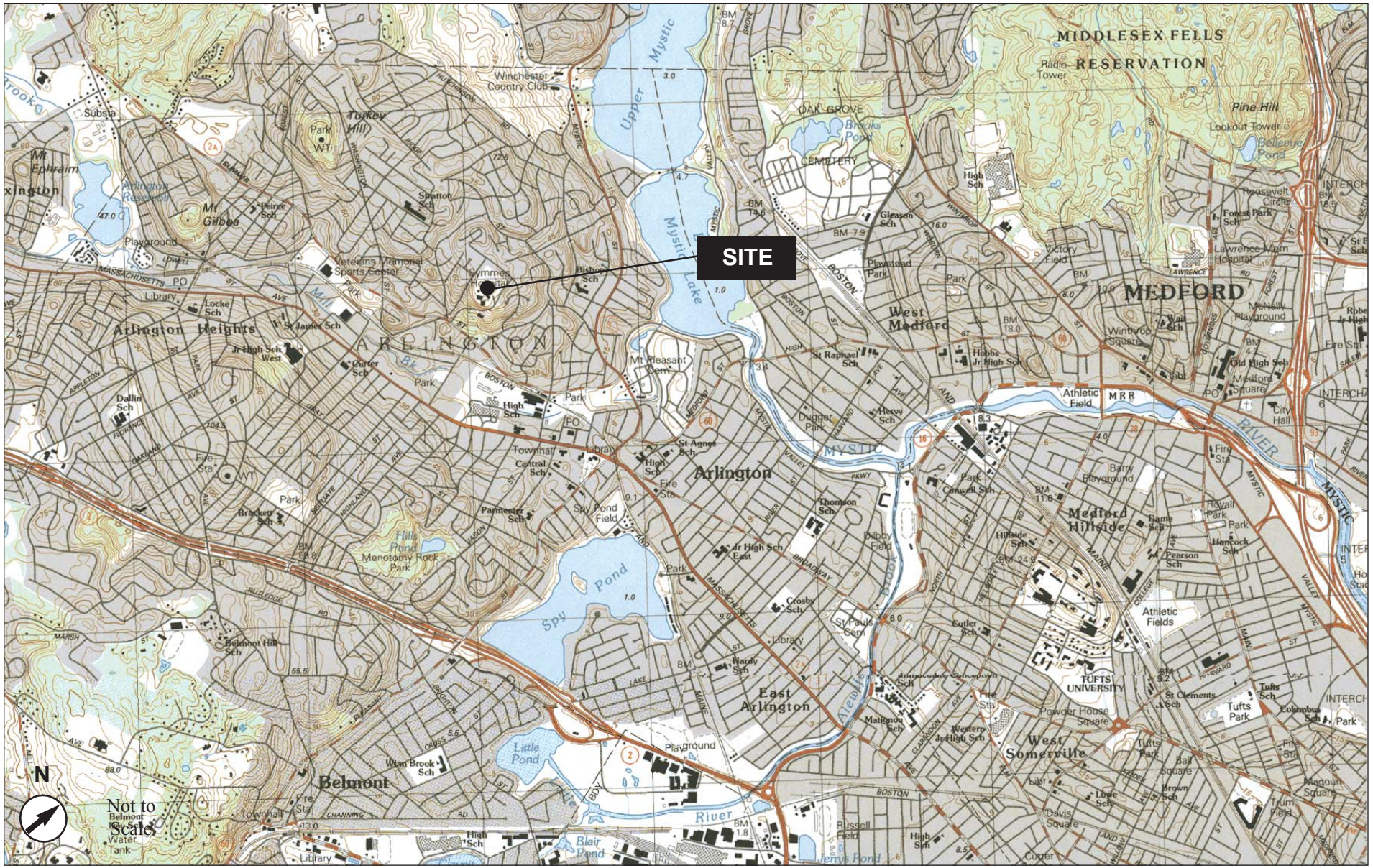
The final section identifies appropriate measures to mitigate any potential project-related impacts.

Site Access and Circulation

The Symmes redevelopment is located on Hospital Road at Summer Street on the site of the former Symmes Hospital. The development is bounded by Summer Street to the south and Woodside Lane to the north, as shown in **Figure 1.** The surrounding area is predominantly residential, with single-family homes.

Vehicular access to and egress from the site occurs via Hospital Road, a private way running through the site to connect to Woodside Lane on the north side. A proposed traffic signal at Hospital Road/Summer Street will be tied into the signal at the intersection of Brattle Street/Summer Street/Hemlock Street. This work will be completed as part of Massachusetts Highway Department (MassHighway) planned improvements at this location.

Figure 1. Locus Map



Existing Transportation Conditions

Traffic Conditions

The study area for the Symmes redevelopment project was identified by the Arlington Selectmen's Transportation Advisory Committee and abutters during community meetings.

Howard/Stein-Hudson Associates (HSH) inventoried traffic conditions in the study area surrounding the site during March–August 2004, including traffic volumes, roadway geometry, signal timings at intersections, and general observations of how the roadways are used by vehicles and pedestrians.

Roadway Conditions

The following roadways make up the study area:

Summer Street is a two-way, urban collector roadway running east to west. It runs from the Lexington town line to the west to the intersection with Route 3 and the Mystic Valley Parkway to the east. The speed limit is 25 mph within the study area. Paved shoulders accompany a single travel lane in each direction, except at the intersections where turning lanes are provided. Parking is generally not allowed within the study area. Sidewalks are present on portions of Summer Street but are not consistent throughout. Signed and marked crosswalks are present at most intersections within the study area.

Hospital Road is a two-way, private roadway running north to south. It runs from its intersection with Summer Street to the south to its intersection with Woodside Lane to the north. The speed limit on Hospital Road is 10 mph. One general, unstriped travel lane is provided for all traffic.

Woodside Lane is a two-way, local roadway running northwest to southeast. It runs from its intersection with Oak Hill Drive to the southwest to its intersection with Jeffrey Road to the northwest. Sidewalks are not provided along Woodside Lane. One general, unstriped travel lane is provided for all traffic.

Brattle Street is a two-way, urban collector roadway running north to south. It runs from its intersection with Massachusetts Avenue to the south to its intersection with Woodside Lane to the north. Brattle Street consists of a single lane in each direction separated by a double yellow centerline.

Parking is allowed on both sides of the street except near the intersections at Massachusetts Avenue and at Summer Street. Sidewalks are present on both sides of the street.

Massachusetts Avenue is a two-way, urban collector roadway running east to west. It spans the entire Town of Arlington, from the Lexington town line to the west to the Cambridge city line to the east. Its speed limit within the study area is 30 miles per hour (mph). Paved shoulders accompany a single travel lane in each direction, except at the intersections where turning lanes are provided. Parking is generally allowed on both sides of the street. Sidewalks are also present on both sides of the street. Signed and marked crosswalks are present at most intersections within the study area.

Hemlock Street is a two-way, local roadway running north to south. It runs from its intersection with Summer Street to the south to its intersection with Fabyan Street to the north. One general, unstriped travel lane is provided for all traffic.

Grove Street is a two-way, urban collector roadway running north to south. It runs from its intersection with Massachusetts Avenue to the south to its intersection with Summer Street to the north. The speed limit is 30 mph along the entire roadway. One general, 30-foot unstriped travel lane is provided for all traffic. Parking is allowed on both sides of the street except near the intersections at Massachusetts Avenue and at Summer Street. Sidewalks are present on both sides of the street.

Oak Hill Drive is a two-way, local roadway running northeast to southwest. It runs from its intersection with Summer Street to the southwest to the Cutter Hill Road/Ridge Street roundabout to the northeast. The speed limit is 25 mph. Parking is generally allowed on both sides along the entire length of the roadway. Sidewalks are present on both sides of the street. One general, unstriped travel lane is provided for all traffic.

Cutter Hill Road is a two-way, local roadway running north to south. It runs from the Oak Hill Drive/Ridge Street roundabout to the north to the intersection of Summer Street to the south. South of the Summer Street intersection, Cutter Hill Road becomes Mill Street. Mill Street continues south until its intersection with Massachusetts Avenue. South of Massachusetts Avenue, it becomes Jason Road. The speed limit within the study area is 25 mph. One general, unstriped travel lane of variable width is provided for all traffic. Sidewalks are only present near the roundabout to the north.

Ridge Street is a two-way, local roadway running east–west. It runs from its intersection with Mystic Street to the east to just beyond Osceola Path to the west. Sidewalks are provided on both sides of the street.

Millett Street is a private way that connects Brattle Street and Lansdowne Road. It serves as a local road carrying very low daily traffic volumes.

One general, unstriped travel lane is provided for all traffic within the study area.

Automatic Traffic Recorder (ATR) counts were taken in the study area during March–May 2004. These counts record the number of vehicles on a roadway segment by hour. The resulting traffic volumes are shown in **Figure 2.** As shown, traffic is highest during the morning and evening commuter hours. The A.M. peak hour is 7:30–8:30 A.M., and the P.M. peak hour is 4:45–5:45 P.M. Average Daily Traffic (ADT) for each of the streets is shown in **Table 1.**

Table 1. 2004 ATR Counts

Roadway	Daily Traffic Volumes (vehicles)
Summer Street (east of Hospital Road)	16,011
Summer Street (west of Brattle Street)	15,347
Hospital Road	907
Woodside Lane	254
Millett Street	118
Brattle Street (north of Summer Street)	395
Brattle Street (south of Summer Street)	2,783
Grove Street	5,934
Oak Hill Drive	1,904
Hemlock Street	2,817

Speed Study

To address community concerns about vehicle speeds on Oak Hill Drive, a 24-hour speed study was performed in May 2004. Results of this study are shown in **Figure 3.**

Oak Hill Drive has a posted speed limit of 25 mph. During the observation periods, the 85th percentile speed was 34 mph for northbound traffic and 33 mph for southbound traffic. Average traffic speeds were 28 mph for northbound and southbound travel. The greatest number of vehicles exceeding 36 miles per hour was recorded between 9:00 A.M. and 12:00 noon and between 3:00 and 6:00 P.M. During these times, approximately 8 percent of the traffic exceeded 36 mph. Approximately 75 percent exceeded the posted 25 mph speed limit between 9:00 A.M. and 12:00 noon and between 3:00 and 6:00 P.M.

Figure 2. Daily Traffic Variations

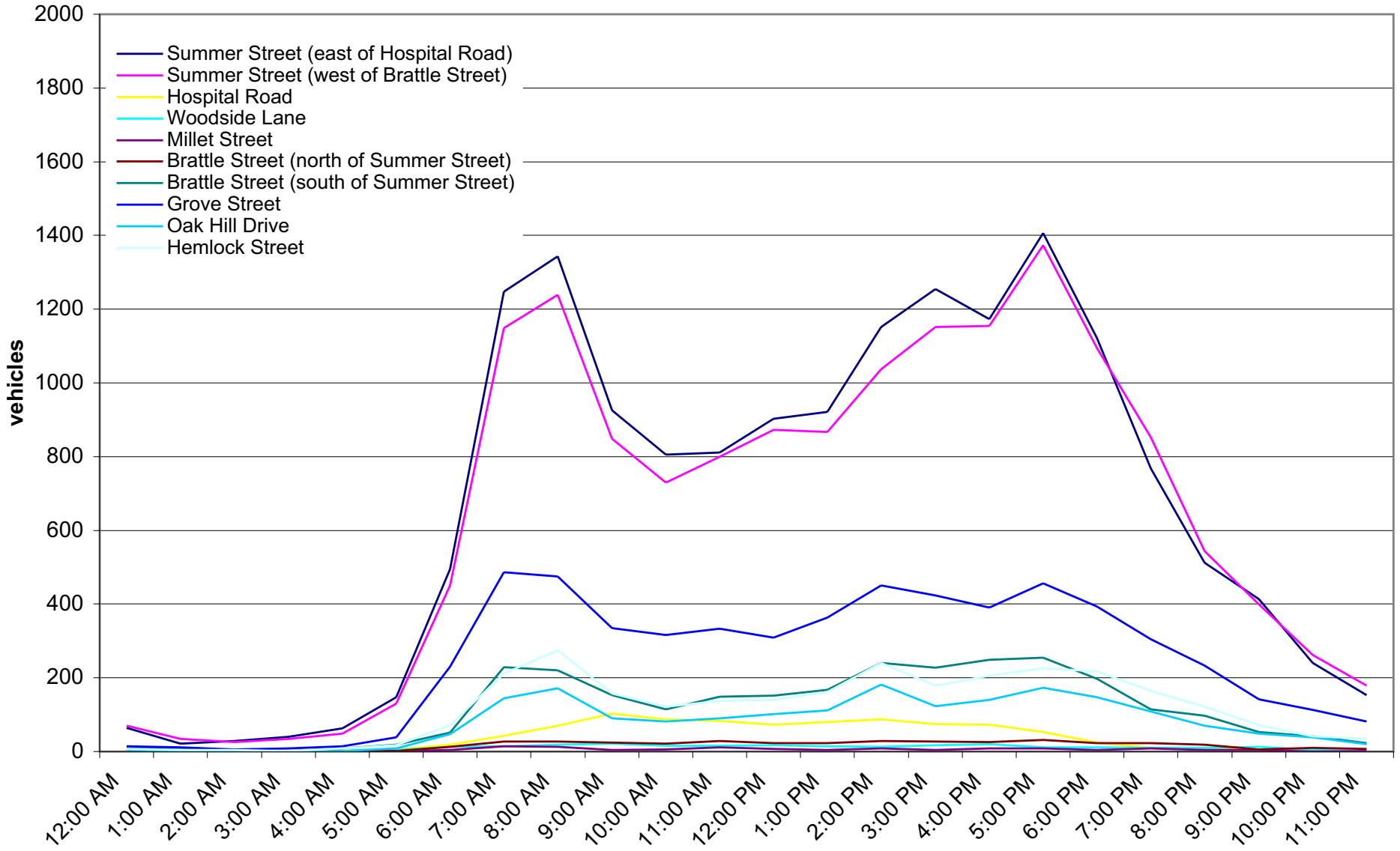
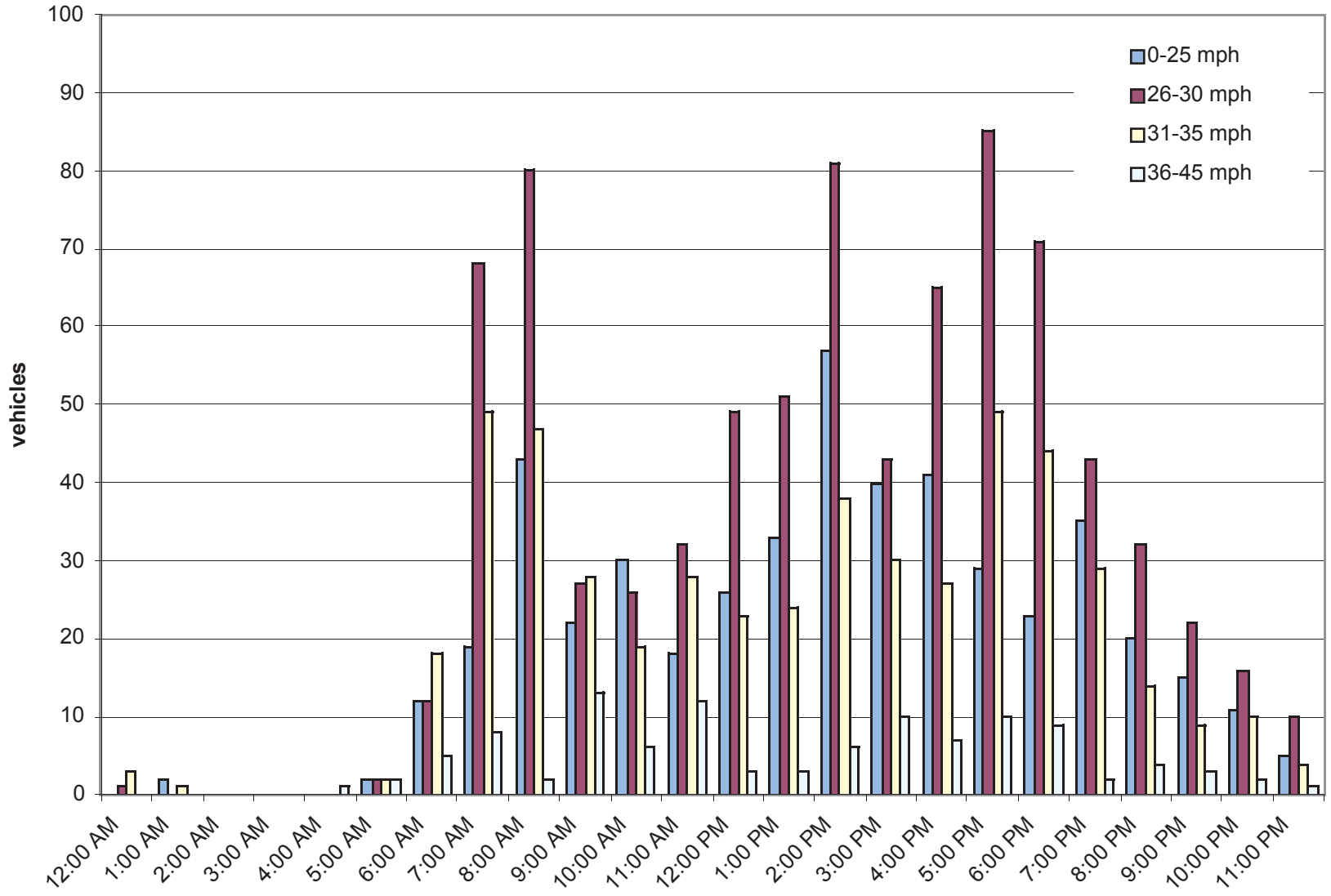


Figure 3. Oak Hill Road Speed Study Results



Intersection Conditions

Figure 4 illustrates the intersections included in the study area. These include the following:

Signalized Intersections

Massachusetts Avenue/Brattle Street is a T-shaped intersection. Massachusetts Avenue runs east to west, with a single lane of traffic in each direction separated by a double yellow centerline. Brattle Street is approximately 26 feet wide and unmarked, terminating at Massachusetts Avenue. Parking is unregulated along the eastbound side of Massachusetts Avenue and the northeast side of the intersection; there is a two-hour limit on parking on the westbound side of Massachusetts Avenue after Brattle Street. Sidewalks are provided on all sides, with crosswalks across all three approaches. A pedestrian pushbutton is located on the northeast corner. Handicapped ramps are located at both sides of Brattle Street, as well as at the eastern-most crosswalk.

Summer Street/Brattle Street/Hemlock Street is a four-leg intersection with both Brattle and Hemlock streets intersecting Summer Street at sharp angles. Summer Street runs east–west and operates as a two-way road with travel separated by a double yellow centerline. Shoulders are provided on both sides of Summer Street, with parking prohibited within the vicinity of the intersection. A triangular island at the end of Brattle Street creates a dedicated right-turn lane onto Brattle Street from eastbound Summer Street. Brattle Street runs southwest–northeast and operates as a two-way road with a double yellow centerline separating the two lanes of travel. Hemlock Street operates with two-way traffic and runs southeast–northwest, ending at Summer Street. No parking is allowed on Hemlock Street. Sidewalks are provided on every corner of the intersection. A single, faded crosswalk exists across Summer Street on the western half of the intersection, with handicapped ramps and pedestrian pushbuttons on both ends. This intersection is scheduled for reconstruction by MassHighway as part of the Summer Street improvement project extending westward to the Lexington town line. These improvements are described in detail in the No-Build Analysis section of this document.

Summer Street/Cutter Hill Road/Mill Street is a four-leg intersection. Summer Street runs east–west and is separated by a paved median. The eastbound approach has a 13-foot through lane, a 10-foot right-turn-only lane, and a 2-foot shoulder; left turns are not permitted on this approach. The westbound approach has an 11-foot left-turn-only lane, a shared through/right lane, and a 6-inch shoulder. Mill Street is the northbound approach, with an 11-foot, shared left/through lane and a 12-foot right-turn-only lane. Cutter Hill Road is the southbound approach, with a single 17-foot travel lane. Right turns on red are prohibited on the eastbound, westbound, and northbound approaches. Sidewalks, crosswalks, handicapped ramps, and pedestrian pushbuttons are located on every corner. Parking is not allowed within the vicinity of the intersection.

Figure 4. Study Area Intersections

Unsignalized Intersections

Massachusetts Avenue/Grove Street is a T-shaped intersection. Massachusetts Avenue runs east to west, while Grove Street runs north to south—with its southern end terminating at the intersection. Massachusetts Avenue has one lane of travel in each direction and is separated by a double yellow centerline; a left turn onto Grove Street can be made from Massachusetts Avenue eastbound without impeding through traffic. Grove Street is approximately 29 feet wide, and the unmarked southbound travel lane is controlled by a stop sign. Sidewalks are provided on all sides, with handicapped ramps located on both the northeast and northwest corners. Parking is not allowed on either side of the Grove Street approach but is unregulated along Massachusetts Avenue. A gas station with two driveways is located on the southern side of the intersection, and a convenience store with driveways on both Grove Street and Massachusetts Avenue is located on the northwest corner.

Summer Street/Hospital Road is a T-shaped intersection located directly east of the Summer Street/Brattle Street/Hemlock Street intersection. The southern end of Hospital Road terminates at Summer Street and is controlled by a stop sign. No parking is allowed on Hospital Road. Sidewalks are present only on Summer Street. An MBTA bus stop for the Route #530 bus is located immediately east of the intersection on Summer Street.

Summer Street/Grove Street is a T-shaped intersection. Summer Street runs east–west, with a 16-foot eastbound travel lane and a 12-foot westbound travel lane separated by a double yellow centerline; 4- to 6-foot shoulders are provided on both sides of Summer Street. Grove Street has a single, unmarked, 30-foot lane for two-way traffic. It runs north–south, with the northern end terminating at Summer Street and controlled by a stop sign. Parking is not allowed within the vicinity of the intersection. Sidewalks are located on the southern side of Summer Street and both sides of Grove Street, but no handicapped ramps are provided. A faded crosswalk is located on the southern side of the intersection, which transverses the end of Grove Street.

Summer Street/Oak Hill Drive is a T-shaped intersection. Summer Street runs east– west, with a 13-foot westbound and 15-foot eastbound travel lane separated by a double yellow centerline; 5-foot shoulders are provided on both sides of Summer Street. Oak Hill Drive runs north–south, with the southern end terminating at the intersection and controlled by a stop sign. Sidewalks are present on both sides of Oak Hill Drive and along the southern side of Summer Street. Faded crosswalks are located both at the end of Oak Hill Drive, as well as crossing Summer Street west of the intersection. Handicapped ramps are not provided.

Woodside Lane/Joyce Road/Oak Hill Drive is a four-leg, offset intersection. Oak Hill Drive has a single, unmarked, 25-foot travel lane for two-way traffic. The eastern end of Woodside Lane terminates at Oak Hill Drive and is controlled by a stop sign. Woodside Lane has a single, unmarked, 27-foot lane for two-way traffic. The western end of Joyce Road terminates at Oak Hill Drive just south of Woodside Lane and is controlled by a stop sign. Joyce Road has a single, unmarked, 27-foot travel lane for two-way traffic. Sidewalks are present on every corner, but

crosswalks and handicapped ramps are not provided. Parking is unregulated in the vicinity of the intersection.

Woodside Lane/Hospital Road is a T-shaped intersection. Woodside Lane runs east–west and has a single, unmarked, 27-foot travel lane for two-way traffic. Hospital Road runs north–south, terminating to the north at Woodside. Hospital Road's single, unmarked, 27-foot travel lane for two-way traffic is controlled by a stop sign. Parking is unregulated within the vicinity of the intersection. Sidewalks and crosswalks are not present.

Cutter Hill Road/Oak Hill Drive/Ridge Street is a four-leg, yield-controlled roundabout. Oak Hill Drive operates as an unmarked, 25-foot, two-way road and runs southwest–northeast, with the northeastern end terminating at the roundabout. Cutter Hill Road operates as an unmarked, 33-foot, two-way road and runs north–south; its north end terminates at the roundabout. Ridge Street is an unmarked, 30-foot, two-way road that enters the roundabout from the east and the north. Crosswalks span all approaches except for Ridge Street. Sidewalks are present on all four corners, but no handicapped ramps are provided. Parking is unregulated on all four approaches.

HSH collected A.M. and P.M. peak-period vehicular turning movement counts and pedestrian counts in the study area in April 2004. Vehicles were classified as either cars or trucks, and the proportion of truck traffic was included in the analysis for each intersection. All counts were taken between 7:00 and 9:00 A.M. and between 4:00 and 6:00 P.M. From the turning movement counts, peak traffic hours were then further defined as 7:30 to 8:30 A.M. and 4:45 to 5:45 P.M.

Traffic Operations

HSH performed an intersection level of service (LOS) analysis to evaluate the level of congestion and estimate vehicle delay at each location. All signalized and unsignalized intersection levels of service were analyzed using Synchro 5 software, developed by Trafficware. Synchro 5 evaluates the effects of closely spaced signalized intersections on one another. It utilizes the percentile delay method for calculating overall control and approach delays for signalized intersections and the *2000 Highway Capacity Manual* (HCM) delay calculations for unsignalized intersections.

LOS designations are based on the resulting average delay per vehicle for all vehicles entering an intersection, as shown in **Table 2.** LOS D or better is typically considered acceptable in an urban area. Volume to capacity ratio is abbreviated as v/c. Queue lengths are measured from the intersection to the last stopped vehicle.

Table 2. Summary of Intersection LOS Delay Categories

Level of Service	Average Control Delay (seconds per vehicle)	
	Signalized Intersection	Unsignalized Intersection
	0–10	0–10
B	10–20	10–15
C	20–35	15–25
D	35–55	25–35
E	55–80	35–50
F	>80	>50

Source: *2000 Highway Capacity Manual.*

HSH obtained intersection geometry information (i.e., number of turning lanes, lane length, and lane width) in the field for the study area intersections. Signal phasing and timing data were obtained from the signal schedules provided by Tri State Signal, the contractor responsible for maintenance of traffic signals in the Town of Arlington, and were verified in the field.

Figure 5 and **Figure 6** show the results of the turning movement counts for the A.M. and P.M. peak hours. The count data used to generate these figures are provided in **Appendix A** of this report. Results of the LOS analysis are provided in **Table 3** and **Table 4.**

Figure 5. Existing Conditions (2004) Turning Movement Counts, A.M. Peak Hour (7:30–8:30 A.M.)

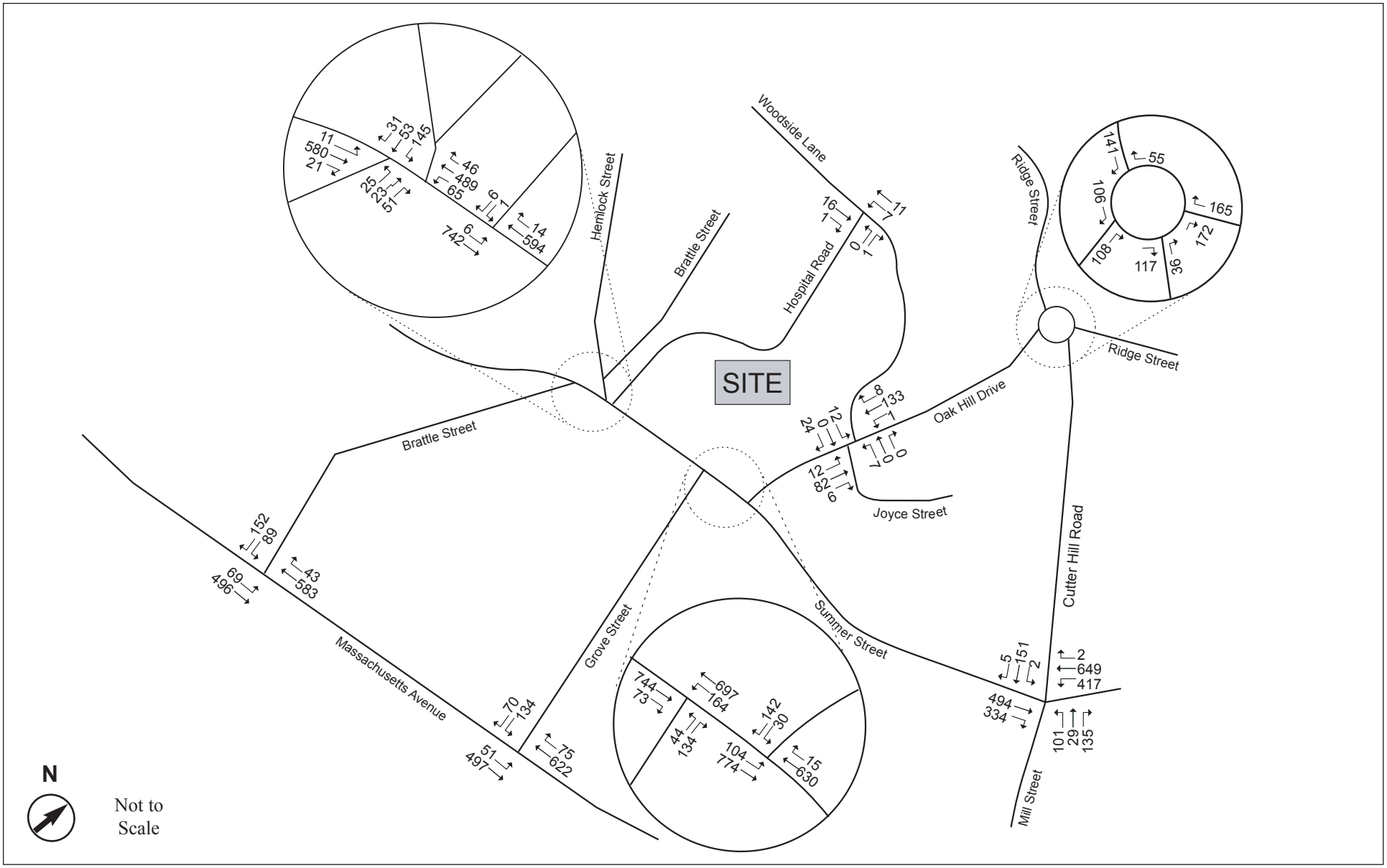


Figure 6. Existing Conditions (2004) Turning Movement Counts, P.M. Peak Hour (4:45–5:45 P.M.)

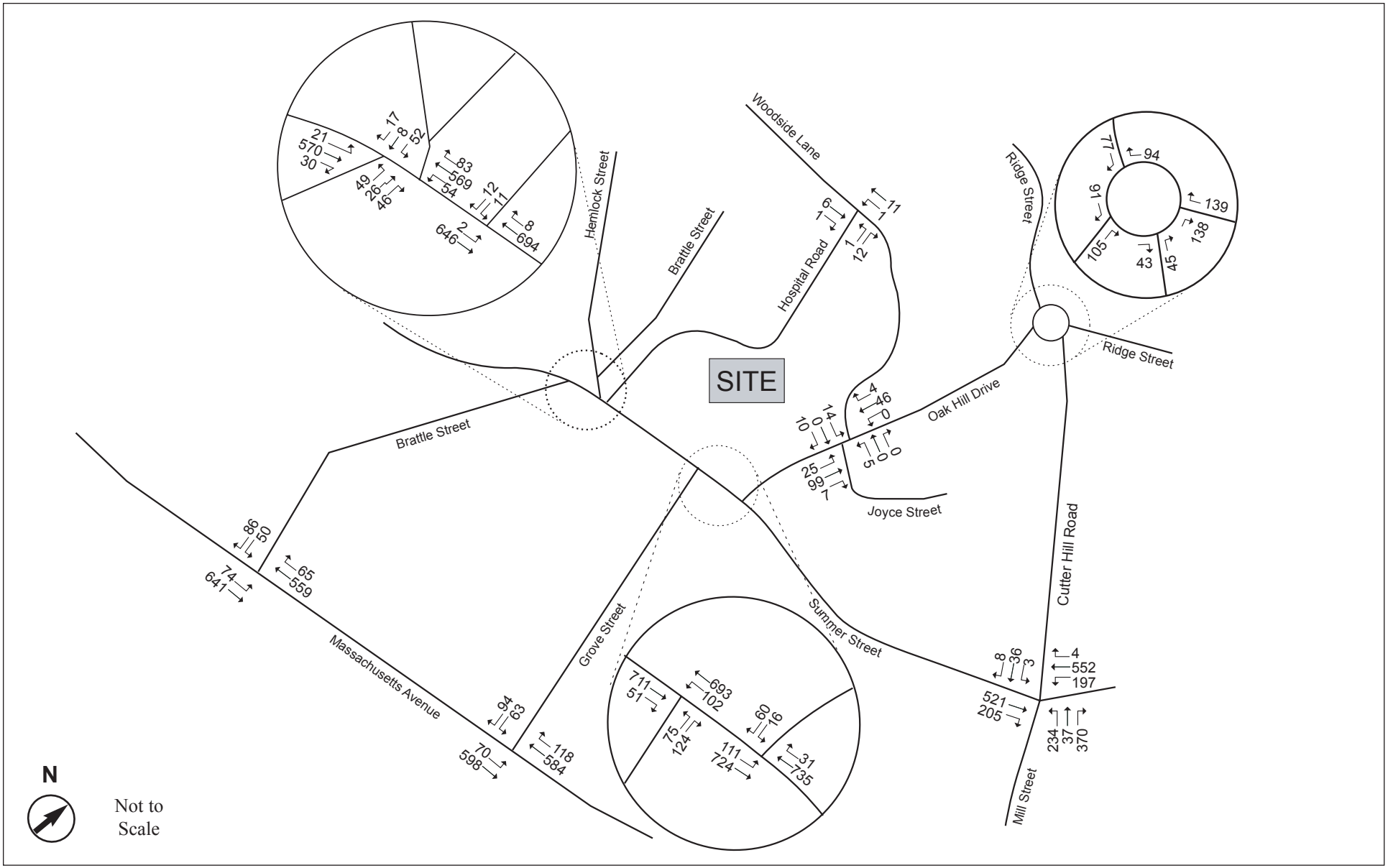


Table 3. Existing Conditions Level of Service, A.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**C**	**28.6**
Summer Street/Brattle Street/Hemlock Street	**C**	**25.2**
Summer Street/Cutter Hill Road/Mill Street	**D**	**47.4**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	2.2
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Hospital Road		
Summer EB left/thru	A	0.2
Summer WB thru/right	A	0.0
Hospital SB left/right	C	18.6
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	A	5.8
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	3.2
Summer WB thru/right	A	0.0
Oak Hill SB left/right	F	>50.0
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	B	10.1
Joyce WB left/thru/right	B	11.5
Oak Hill NB left/thru/right	A	1.0
Oak Hill SB left/thru/right	A	0.1
Woodside Lane/Hospital Road		
Woodside EB thru/right	A	0.0
Woodside WB left/thru	A	2.9
Hospital left/right	A	8.5
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	9.2
Ridge WB left/thru/right	A	9.6
Cutter Hill NB left/thru/right	A	8.0
Ridge SB left/thru/right	A	9.5

Table 4. Existing Conditions Level of Service, P.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**C**	**33.5**
Summer Street/Brattle Street/Hemlock Street	**C**	**23.1**
Summer Street/Cutter Hill Road/Mill Street	**D**	**36.4**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	3.1
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Hospital Road		
Summer EB left/thru	A	0.1
Summer WB thru/right	A	0.0
Hospital SB left/right	C	24.8
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	A	3.5
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	3.8
Summer WB thru/right	A	0.0
Oak Hill SB left/right	E	41.2
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	A	9.9
Joyce WB left/thru/right	B	10.7
Oak Hill NB left/thru/right	A	1.6
Oak Hill SB left/thru/right	A	0.0
Woodside Lane/Hospital Road		
Woodside EB thru/right	A	0.0
Woodside WB left/thru	A	0.6
Hospital left/right	A	8.5
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	8.8
Ridge WB left/thru/right	A	8.7
Cutter Hill NB left/thru/right	A	8.0
Ridge SB left/thru/right	A	8.4

As shown in the tables, the study area intersections generally operate at LOS D or better during both the A.M. and the P.M. peak hours, with exceptions on some approaches. The Massachusetts Avenue/Brattle Street intersection operates with an overall LOS C during both the morning and evening peaks, but the eastbound Massachusetts Avenue left-turn operates at LOS F. This is due to a large volume of westbound traffic in a single lane and the lack of a protected eastbound left-turn phase. On average, approximately 2 vehicles per cycle make this turn, so the queue remains small.

At the Summer Street/Brattle Street/Hemlock Street intersection, the queues along eastbound and westbound Summer Street are long in both the morning and evening peak hours; westbound queues stack well beyond the Hospital Road intersection. While long queues can lead to driver frustration, it has been observed that they do clear the intersection within a single traffic cycle—hence the short delay. SimTraffic analysis of this intersection supports these observations.

At the Summer Street/Cutter Hill Road/Mill Street intersection, overall level of service for the morning and evening peaks is LOS D, but the northbound approach operates at LOS F. The long delays on the approach are caused by a very long cycle length that allots a significant percentage of its green time to the Summer Street approaches, giving vehicles at the Mill Street approach a red signal that could be as long as 111 seconds.

The minor approaches on three of the unsignalized intersections—Massachusetts Avenue/Grove Street, Summer Street/Grove Street, and Summer Street/Oak Hill Drive—operate at LOS E or LOS F, according to the model. However, field observations do not reflect delays on these approaches that exceed 35 seconds. The calculated delays exceed the actual delays for two reasons: a general factor is used in the calculation to estimate the platoons of vehicles and gaps in traffic that naturally occur. However, this factor does a poor job of modeling these gaps and does not account for aspects such as nearby traffic signals that create defined gaps that benefit vehicles waiting at the stop sign. Additionally, the model tends to be very conservative when estimating a driver's aggressiveness. In an urban setting, especially in the Northeast, drivers are more likely to accept smaller gaps in traffic, especially as their stopped time increases.

Crash Data

Accident data for intersections within the study area for the years 2000 through 2002 were obtained from the Massachusetts Highway Department and are presented in **Appendix B.** From 2000 through 2002, the intersection of Massachusetts Avenue/Brattle Street had 8 reported accidents, Massachusetts Avenue/Grove Street had 4, Summer Street/Brattle Street had 6, Summer Street/Grove Street had 11, Summer Street/Mill Street had 10, Oak Hill Drive/Woodside Lane had 1, and Woodside Lane/Hospital Road had 1. The resulting crash rates, per MassHighway standard calculations, are summarized in **Table 5.**

Table 5. Crash Rate Summary

Intersection	Intersection Type	Crash Rate	State Average
Massachusetts Avenue/Brattle Street	Signalized	0.45	0.87
Massachusetts Avenue/Grove Street	Unsignalized	0.22	0.63
Summer Street/Brattle Street	Signalized	0.49	0.87
Summer Street/Grove Street	Unsignalized	0.51	0.63
Summer Street/Mill Street	Signalized	0.38	0.87
Oak Hill Drive/Woodside Lane	Unsignalized	0.39	0.63
Woodside Lane/Hospital Road	Unsignalized	2.57	0.63

According to MassHighway standards, none of the intersections have elevated crash rates, with the exception of Woodside Lane/Hospital Road. Although only one single-vehicle accident occurred over the three-year period, the crash rate is elevated due to the extremely low traffic volumes on Woodside Lane. These two factors suggest that mitigation would not be warranted in order to increase safety.

Public Transportation

Massachusetts Bay Transportation Authority (MBTA) bus routes near the site are shown in **Table 6.**

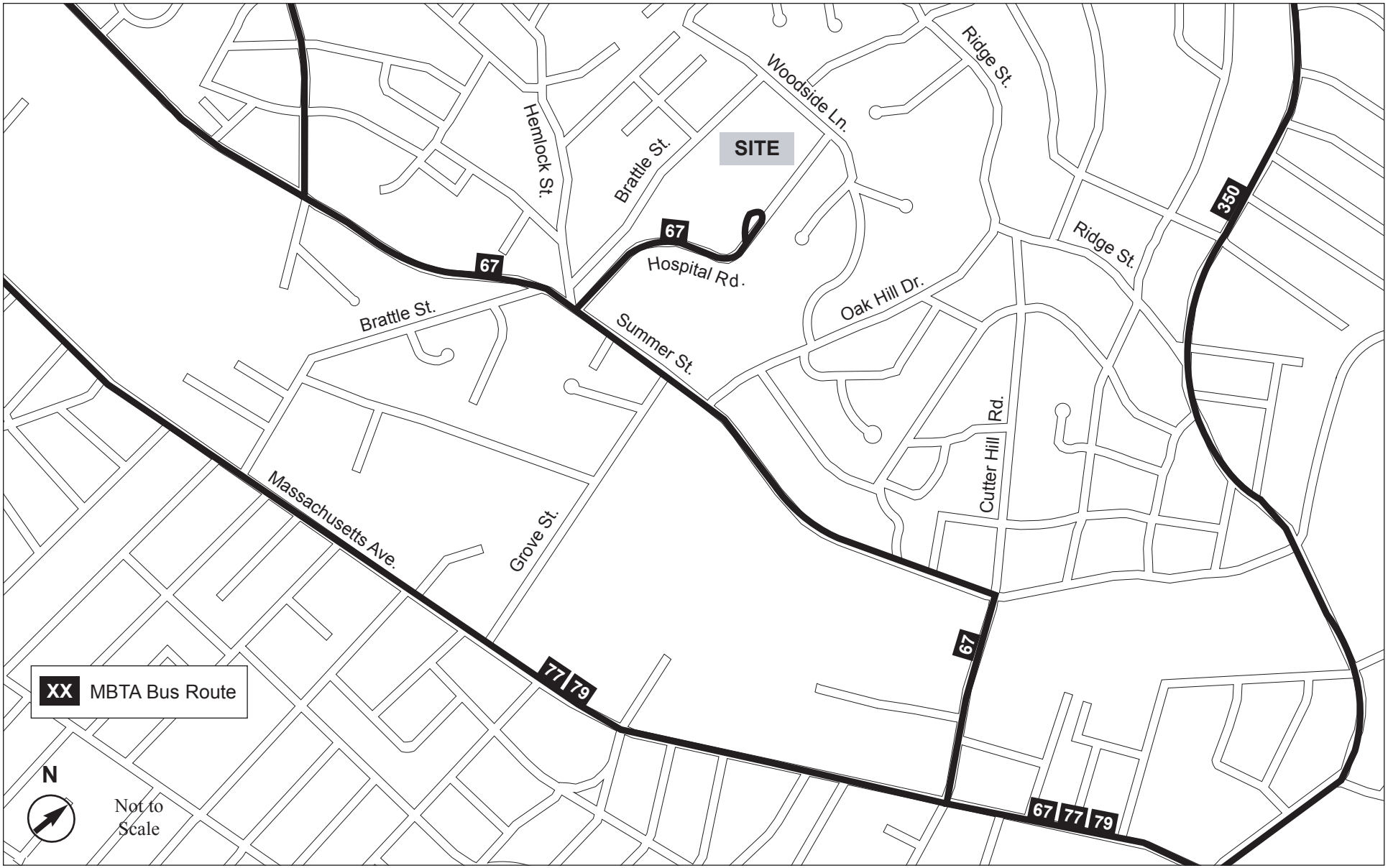
Table 6. Existing MBTA Bus Service

Bus Route	Description	Rush-hour Frequency (min.)	Ridership (weekday avg.)
67	Alewife Station–Turkey Hill Reservation	25	493
77	Arlington Heights–Harvard Station	8	7,595
79	Arlington Heights–Alewife Station	12	1,579
350	North Burlington–Alewife Station	20	1,537

Sources: www.mbta.com and MBTA Ridership and Service Statistics, 2004, based on 2003 Ridecheck Program.

MBTA bus route #67, as shown in **Figure 7,** contains an outbound stop within the project site at the hospital entrance. The closest inbound stop is located on Summer Street at Hospital Road. The #67 bus connects the hospital to both Turkey Hill Reservation and Alewife Station, where bus passengers can connect to the MBTA Red Line. From the Red Line, transit riders can transfer to the Green Line at Park Street or the Orange Line at Downtown Crossing. Route #67 operates between 6:20 A.M. and 8:30 P.M. Weekday subway service is provided between approximately 5:00 A.M. and 1:00 A.M.

Figure 7. Public Transportation in the Study Area



Bus routes #77 and #79 are also relatively close to the project site. Bus route #77 travels on Massachusetts Avenue, connecting Arlington Heights and Harvard Station, with stops at Arlington Center and Porter Station. Both Porter and Harvard stations provide connections to the Red Line. Bus Route #79 travels on Massachusetts Avenue, connecting Arlington Heights and Alewife Station. Bus routes #77 and #79 operate between 4:30 A.M. and 1:30 P.M. and between 6:30 A.M. and 10:00 P.M., respectively.

Bus Route #350 connects North Burlington with Alewife Station, with stops at Woburn, Arlington Center, and the Burlington Mall. Service is provided weekdays between 6:15 A.M. and 11:00 P.M.

Parking

Surface parking is currently provided on-site for approximately 360 vehicles in 3 parking areas. The main Hospital lot is located at the crest of Hospital Road and provides parking for employees and visitors to the Lahey Clinic currently operating on-site. Two additional lots are provided for the Nurses' Building off Hospital Road.

Loading

Loading currently occurs on-site in the surface parking areas. A dumpster is located on the west side of the West and North sections of the Symmes Hospital Building.

Pedestrians

Schools in the immediate vicinity of the site were located as shown in **Figure 8.**

Due to a lack of sidewalks, the Symmes site is more oriented to automobiles than pedestrians. Several Arlington residents use the site for exercise such as walking, jogging, or bicycling. In addition, some residents use the site to walk their dogs. No after-hours security or pedestrian-friendly lighting is provided on-site. Therefore, once the Hospital closes in the evening, the site is usually vacant.

No sidewalks are currently provided on Hospital Road between Summer Street and Woodside Road.

Peak-hour pedestrian crossing volumes were taken simultaneously with vehicle turning movement counts. The resulting volumes are shown in **Figure 9.**

Figure 8. Schools in the Study Area

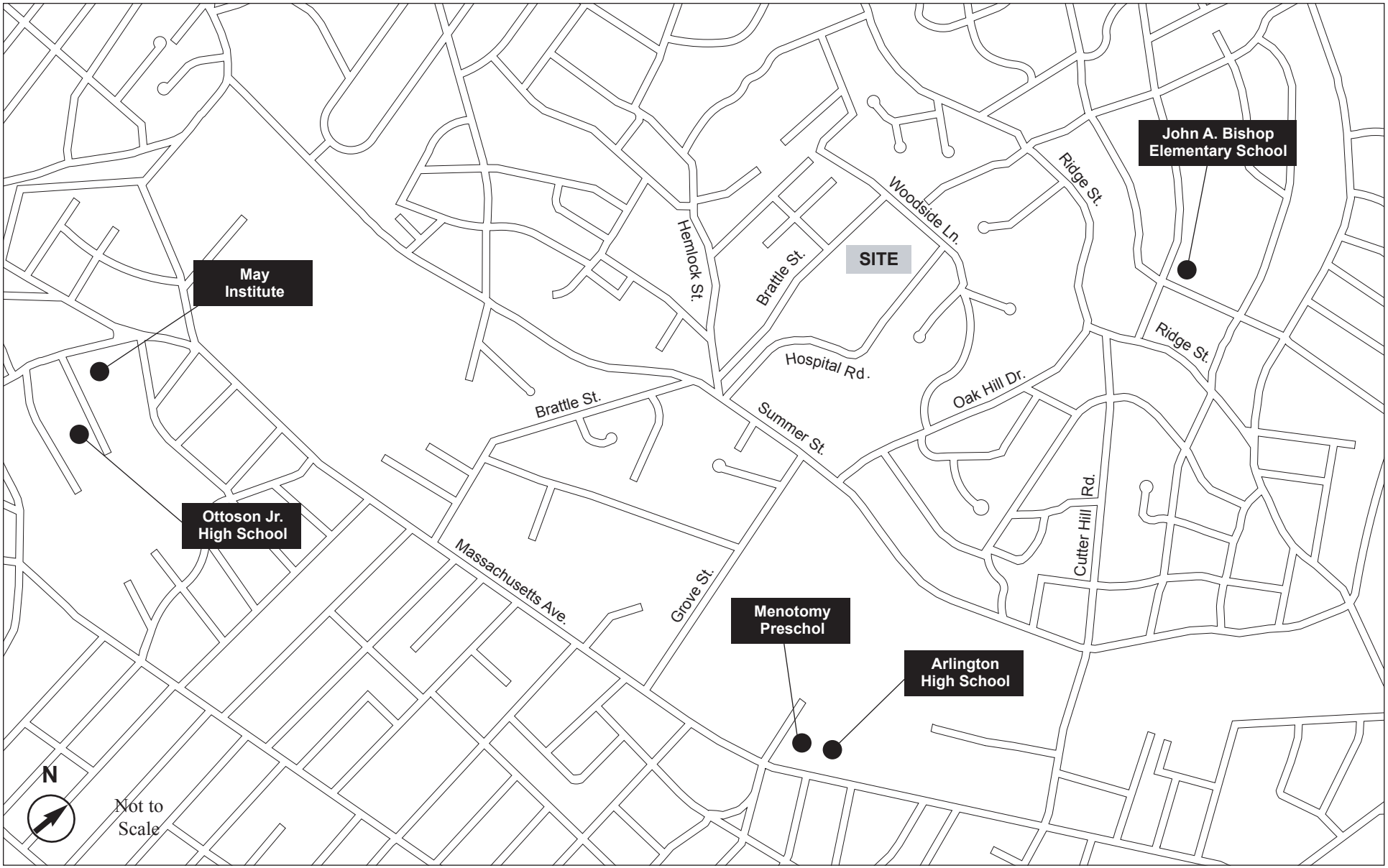
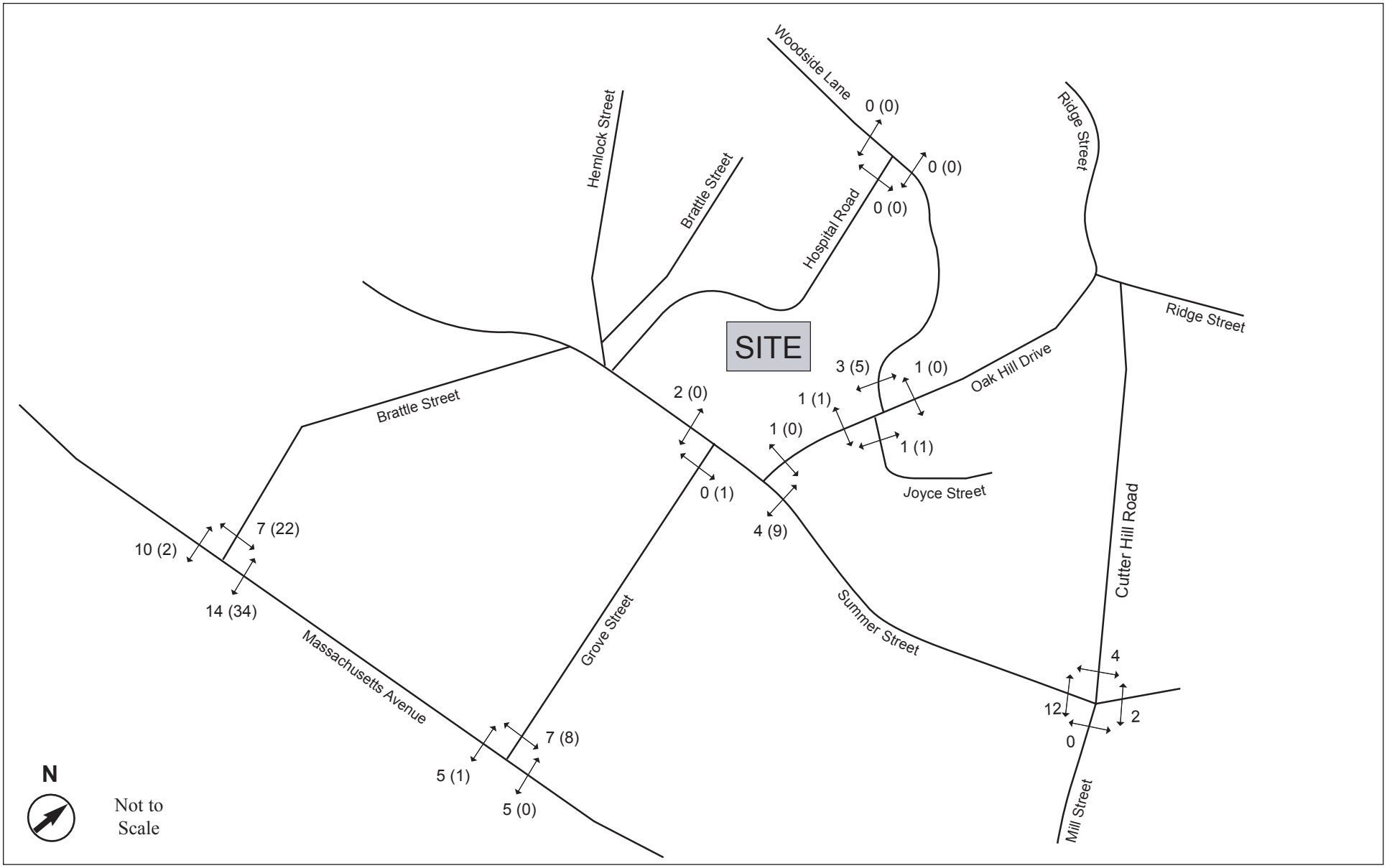


Figure 9. Existing Pedestrian Conditions (2004) Volumes, A.M. (P.M.)



Evaluation of Long-term Transportation Impacts

No-Build Scenario

The No-Build Scenario presents the anticipated traffic patterns in the future year 2009 without the proposed Symmes redevelopment. For this condition, other area projects and anticipated increases in traffic as a result of increased auto ownership are added to the Existing Conditions traffic analysis model.

Background Traffic Growth

A growth rate of 0.5 percent per year was used to project future traffic volumes in the area that will increase due to a general growth in population and increased auto dependency. This growth rate assumption was based on vehicle counts taken in 1998 and counts taken for this project in 2004 at the Summer Street/Brattle Street/Hemlock Street intersection. Vehicular traffic has actually decreased 0.8 percent per year at this location since 1998, but an increase of 0.5 percent per year was used in order to be conservative.

Other Area Projects

The following projects are expected to influence traffic patterns in the study area and are included in the No-Build traffic model:

MassHighway plans to reconstruct the Summer Street/Brattle Street/Hemlock Street intersection as part of ongoing improvements along the Route 2A corridor. The work will include installation of new traffic signals and a new signal controller, new curbs and sidewalks, and new pavement markings, including new crosswalks. In addition to the new signal equipment, the traffic signal cycle length – the time needed to complete all of the signal phases – is lengthened and protected left-turn phases for westbound Summer Street and southbound Hemlock Street are added. The new geometry and changes to the traffic signal are reflected in the No-Build analysis.

No-Build Traffic Operations

No-Build traffic volumes were calculated by factoring up the Existing Conditions turning movement counts by a 0.5 percent annual growth rate and totaling the project-added trips from each development described above.

No-Build traffic volumes for the A.M. and P.M. peak hours are shown in **Figure 10** and **Figure 11.** Intersection No-Build level of service and queuing length at study area locations are shown in **Table 7** and **Table 8.** The shaded cells in the tables denote traffic movements that decrease by one or more levels of service between Existing and No-Build Conditions. Detailed Synchro reports are provided in **Appendix C.**

In general, there is little change in traffic operations between the Existing and No-Build scenarios. This is primarily due to an increase of only 0.5 percent per year in background traffic and the MassHighway upgrades on Summer Street. The MassHighway improvements at Summer Street/Brattle Street/Hemlock Street slightly decrease the delay during the morning and evening peak hours, including improving the overall operation from LOS C to LOS B in the P.M. The intersection of Massachusetts Avenue/Brattle Street drops from an overall LOS C to LOS D during the evening peak hour, but the actual increase in delay is fewer than 4 seconds.

In addition to the No-Build scenario that is based on existing conditions, an analysis of the signalized intersections with optimized signal timings was performed with the No-Build volumes. This condition was analyzed in order to show the maximum efficiency that can be achieved at these intersections if regular review and maintenance is performed. Traffic signal timings are optimized by changing the cycle length and/or changing the amount of green time allotted to certain approaches in order to minimize delays and queue lengths at the intersection. While no major improvements can be made during the morning peak hour, Massachusetts Avenue/Brattle Street can improve from LOS D to LOS B, and Summer Street/Mill Street/Cutter Hill Avenue can improve from LOS D to LOS C during the evening peak, as shown in **Table 9.**

Figure 10. No-Build Conditions (2009) Turning Movement Counts, A.M. Peak Hour (7:30–8:30 A.M.)

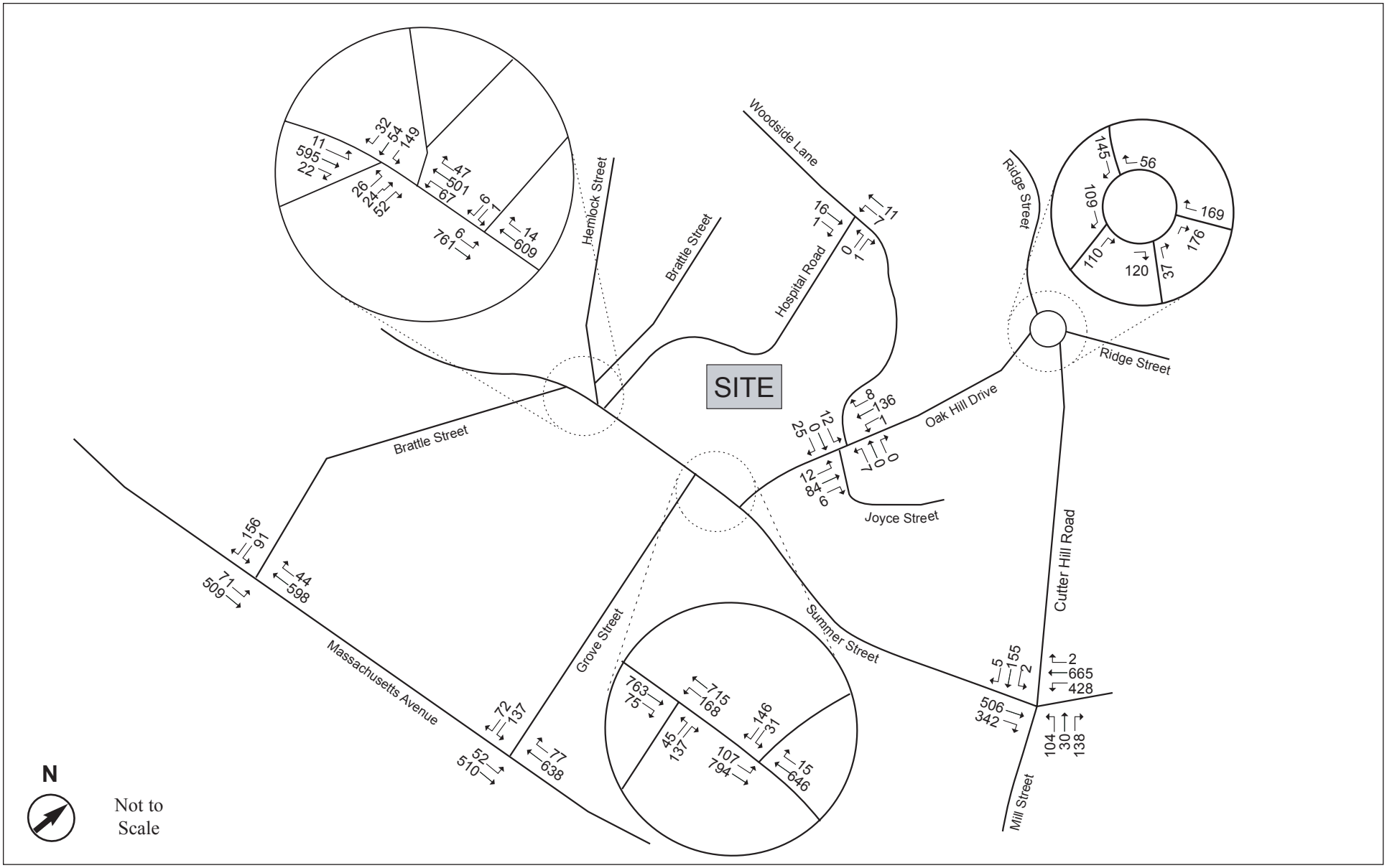


Figure 11. No-Build Conditions (2009) Turning Movement Counts, P.M. Peak Hour (4:45–5:45 P.M.)

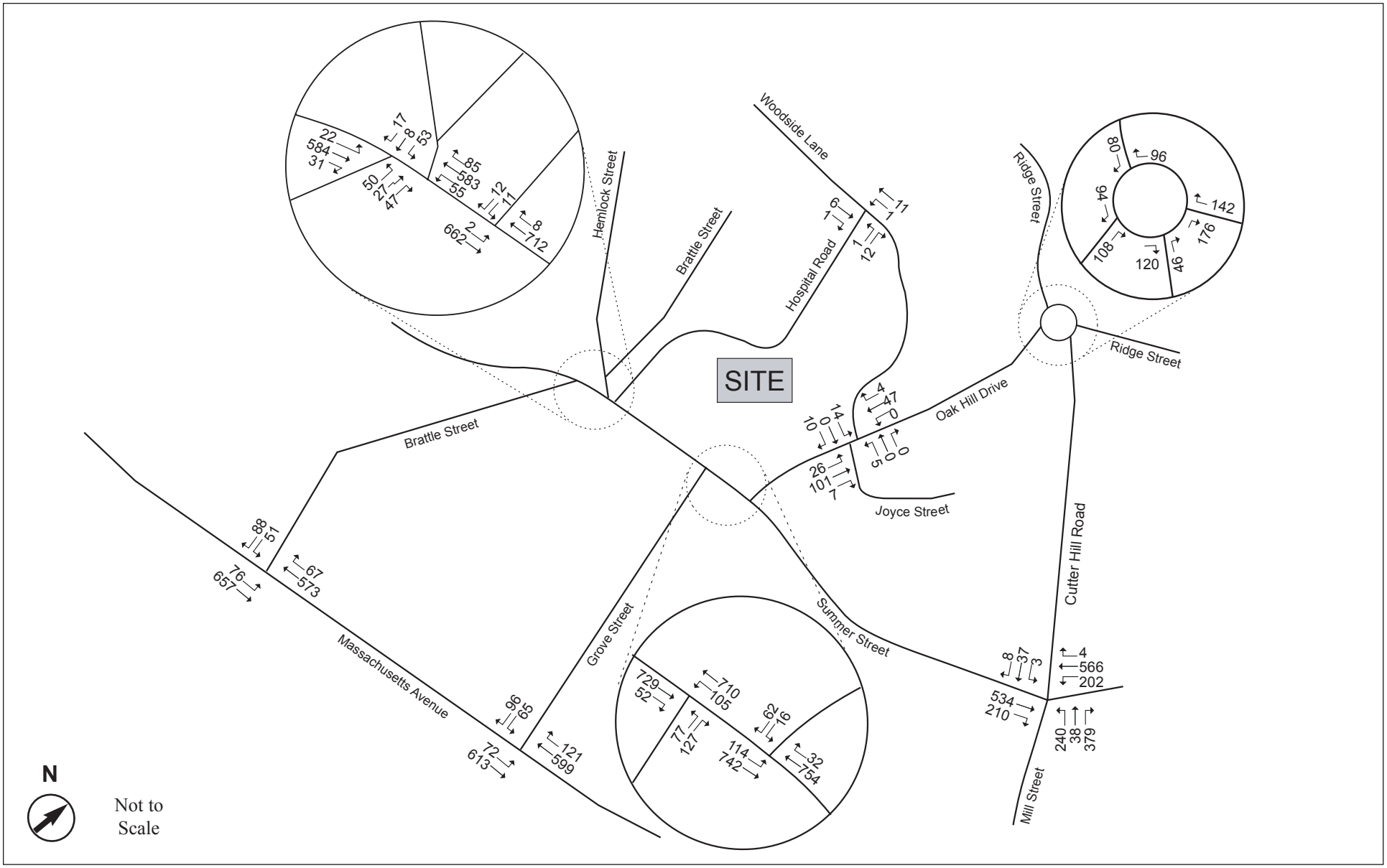


Table 7. No-Build Conditions Level of Service, A.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**C**	**31.6**
Summer Street/Brattle Street/Hemlock Street	**C**	**25.0**
Summer Street/Cutter Hill Road/Mill Street	**D**	**49.2**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	2.3
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Hospital Road		
Summer EB left/thru	A	0.2
Summer WB thru/right	A	0.0
Hospital SB left/right	C	19.1
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	A	6.2
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	3.4
Summer WB thru/right	A	0.0
Oak Hill SB left/right	F	>80.0
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	B	10.1
Joyce WB left/thru/right	B	11.6
Oak Hill NB left/thru/right	A	1.0
Oak Hill SB left/thru/right	A	0.1
Woodside Lane/Hospital Road		
Woodside EB thru/right	A	0.0
Woodside WB left/thru	A	2.9
Hospital left/right	A	8.5
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	9.3
Ridge WB left/thru/right	A	9.7
Cutter Hill NB left/thru/right	A	8.1
Ridge SB left/thru/right	A	9.7

Table 8. No-Build Conditions Level of Service, P.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**D**	**36.9**
Summer Street/Brattle Street/Hemlock Street	**B**	**19.2**
Summer Street/Cutter Hill Road/Mill Street	**D**	**39.4**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	3.3
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Hospital Road		
Summer EB left/thru	A	0.1
Summer WB thru/right	A	0.0
Hospital SB left/right	D	25.9
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	A	3.7
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	4.0
Summer WB thru/right	A	0.0
Oak Hill SB left/right	E	45.4
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	A	9.9
Joyce WB left/thru/right	B	10.7
Oak Hill NB left/thru/right	A	1.6
Oak Hill SB left/thru/right	A	0.0
Woodside Lane/Hospital Road		
Woodside EB thru/right	A	0.0
Woodside WB left/thru	A	0.6
Hospital left/right	A	8.5
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	8.8
Ridge WB left/thru/right	A	8.7
Cutter Hill NB left/thru/right	A	8.0
Ridge SB left/thru/right	A	8.5

Table 9. No-Build Conditions—Optimized Level of Service, Signalized Intersections

Intersection/Movement	LOS	Delay (sec.)
A.M. Peak Hour		
Massachusetts Avenue/Brattle Street	**C**	**26.4**
Summer Street/Brattle Street/Hemlock Street	**C**	**20.5**
Summer Street/Cutter Hill Road/Mill Street	**D**	**49.2**
P.M. Peak Hour		
Massachusetts Avenue/Brattle Street	**B**	**18.7**
Summer Street/Brattle Street/Hemlock Street	**B**	**11.8**
Summer Street/Cutter Hill Road/Mill Street	**C**	**31.4**

Build Scenario

The Symmes redevelopment consists of the development program shown in **Table 10.** The development is predominantly residential, with condominiums constructed at the top of the hill, as shown in **Figure 12.** Medical office space will be provided at the site of the existing Nurses' Building on Hospital Road.

Table 10. Development Program

	Existing	Proposed
Residential	0	275
Medical Office Space	24,706*	40,000
Parking	360	626

* Existing occupied hospital space.

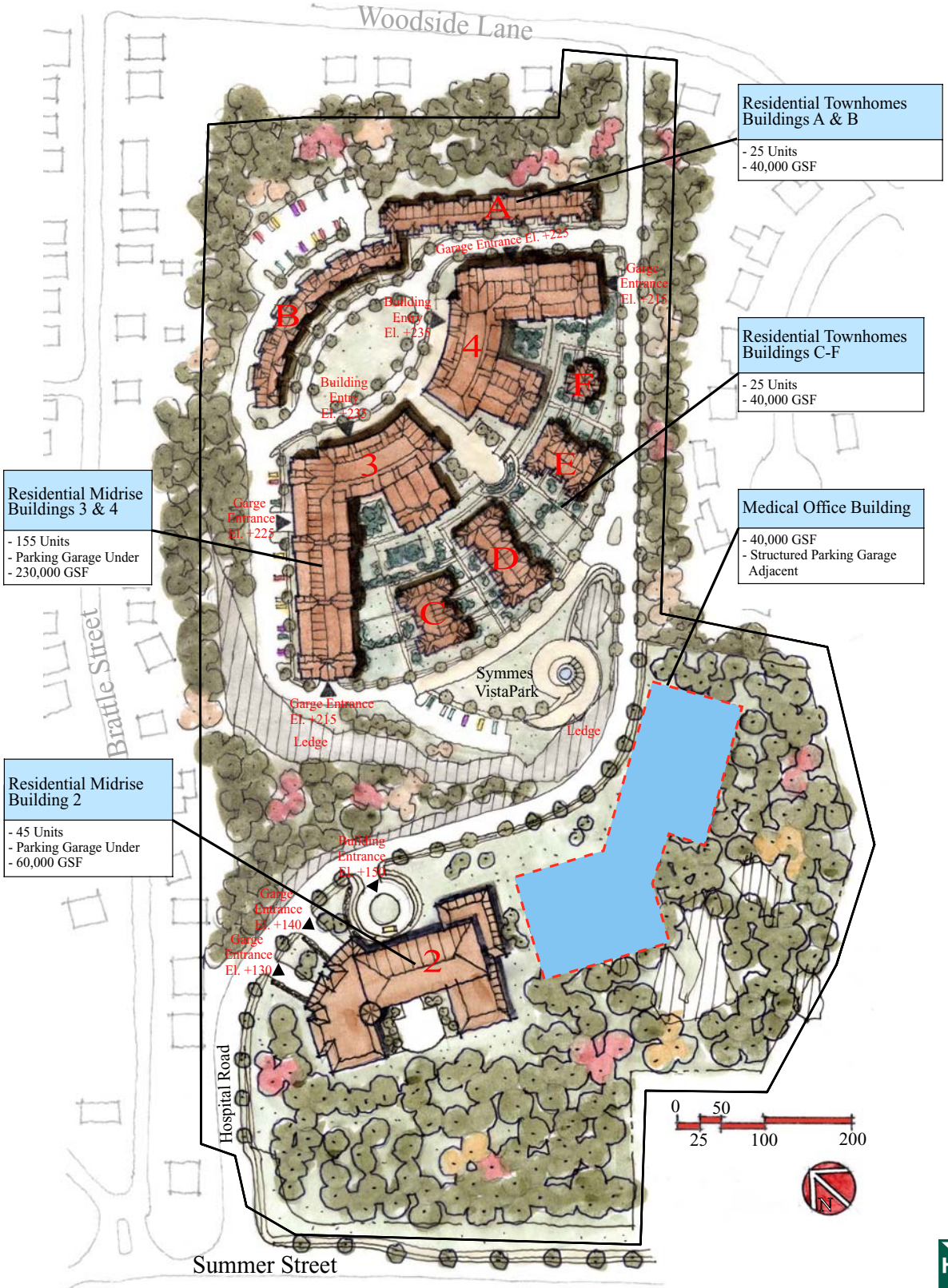
Two alternatives are presented for the existing Hospital Road connection to Woodside Lane:

- Option 1 presents traffic operations with Woodside Lane open for general travel.
- Option 2 reflects closure of Hospital Road at Woodside Lane.

Trip Generation

Trip generation data were derived from the Institute of Transportation Engineers (ITE) *Trip Generation,* 7th edition (2003). Trips were calculated on a per-dwelling-unit basis. The trips are then reallocated to vehicle, transit, and walk/bike trips based on the area mode split (described in the next section). The following ITE land use codes were used:

Figure 12. Site Plan



Land Use Code 230: Residential Condominium
This land use code refers to units with single-family ownership that have at least one other single-family-owned unit with the same building structure. Calculation of the number of trips uses ITE's average rate per dwelling unit.

Land Use Code 720: Medical-Dental Office Building
A medical-dental office building is a facility that provides diagnoses and outpatient care on a routine basis but is unable to provide prolonged in-house medical and surgical care. This type of facility is generally operated by one or more private physicians or dentists.

Mode Split

Mode split—the proportion of persons who travel to the site via auto, transit, and walking/other—was estimated using the 1990 and 2000 Census journey-to-work data and the Central Transportation Planning Staff (CTPS) 1991 household survey. **Table 11** summarizes the estimated mode split for future residents, employees, and visitors at the site.

Table 11. Peak-hour Mode Split

Mode of Travel	Residents	Medical
Drive	92.7%	86%
Transit	6.8%	10%
Walk/bike/other	0.5%	4%
Total	**100%**	**100%**

Source: 1990 and 2000 Census Data.

Based on the above assumptions and using ITE rates, traffic generated by Symmes Hospital when it was fully operational and as it exists today (only 24,706 square feet occupied) is shown in **Table 12.**

Table 12. Existing Vehicle Trip Generation

	Fully Operational Hospital*	Current Site (2004)**
Daily	4,540	768
In	2,270	384
Out	2,270	384
A.M. Peak	245	36
In	195	28
Out	50	8
P.M. Peak	255	51
In	75	12
Out	180	39

*Source: VHB memorandum, January 8, 2003.
**Daily estimated from ITE rates; peak hours taken from count data.

The proposed Symmes redevelopment trip generation is summarized in **Table 13.** Trip generation for the individual land uses is presented in detail in **Appendix D.**

Table 13. Project Trip Generation

		Walk/Bike/Other (persons)		Transit (persons)		Auto (vehicles)	
		Residential	Medical	Residential	Medical	Residential	Medical
Daily	Total	8	64	120	158	1494	1244
	In	4	32	60	79	747	622
	Out	4	32	60	79	747	622
A.M.	Total	1	4	9	10	113	85
	In	0	3	1	8	18	67
	Out	1	1	8	2	95	18
P.M.	Total	133	128	10	16	134	129
	In	90	35	7	4	90	35
	Out	44	94	3	12	44	94

Source: ITE *Trip Generation,* 7th Edition.

As shown, the project will generate a total of 1,369 entering and 1,369 exiting vehicle trips each day. These include 85 vehicle trips entering and 113 vehicles exiting during the A.M. peak hour and 125 vehicle trips entering and 138 exiting during the P.M. peak hour. The daily vehicle trip estimate for the proposed redevelopment is approximately 40 percent less compared to when the hospital was

fully operational. Peak-hour trips are also equal to or less than trips generated by the fully occupied hospital.

For trip generation estimates, the peak hours of adjacent street traffic (7:00–9:00 A.M. and 4:00–6:00 P.M.) were used for the medical component, since the worst-case scenario for project-generated traffic is when traffic on the adjacent roadways is at its highest. The peak hour of generator for the medical use will be between 9:00 and 10:00 A.M. and between 2:00 and 3:00 P.M., as it is today on-site. The traffic during these times is shown in **Table 14.** During this time the residential component will generate negligible traffic. For this reason, the project will generate more traffic during the peak hour of adjacent street traffic, when residents will be exiting the site and employees entering or vice versa.

Table 14. Medical Office: Peak Hour of Operation

	A.M. Peak Generator (9:00–10:00 A.M.)	**P.M. Peak Generator (2:00–3:00 P.M.)**
Total	126	154
In	83	62
Out	43	92

Existing trips to the site today (2004), based on counts, were then compared to the project-generated vehicle trips. Results are shown in **Table 15.**

Table 15. Comparison of Vehicle Trips

		Existing (2004)	**Total Project Trips**	**Net New**
Daily	Total	768*	2738	1970
	In	384*	1369	985
	Out	384*	1369	985
A.M.	Total	36	198	162
	In	28	85	57
	Out	8	113	105
P.M.	Total	48	263	215
	In	12	125	113
	Out	36	138	102

*Daily estimated from ITE rates; peak hours taken from count data.

Trip Distribution

Vehicle trip distribution is also determined by using U.S. Census Journey to Work information for the census tract where the development occurs. Based on these data, the distribution of both home-based

work trips (used for residents living at the site) and work-based trips (used for employees working at the site) for the census tract are as shown in **Table 16.** A detailed methodology for assigning the regional and local trips to the street network can be found in **Appendix E.**

Table 16. Trip Distribution

Travel Corridor		% Home-based [1]	% Work-based [2]
Regional			
	Mystic Valley Parkway to/from east	26.7%	22.4%
	Route 2 to/from east	15.4%	5.9%
	Route 2 to/from west	15.0%	11.7%
	Route 3 (Mystic Street) to/from north	9.0%	8.6%
	Route 2A and 3 (Massachusetts Avenue/Broadway) to/from southeast	8.3%	6.1%
	Route 2A (Summer Street) to/from west	3.6%	2.0%
	Route 60 (Pleasant Street) to/from south	5.7%	1.1%
	Park Avenue to/from south	1.6%	1.9%
Local*			
	Arlington	14.7%	40.3%
Totals		**100.0%**	**100.0%**

Source: 1) U.S. Census 2000 Journey to Work data.
2) U.S. Census 1990 Journey to Work data.
* Local traffic is proportionally assigned to each of the regional approach corridors according to the regional traffic percentages and added to regional traffic in order to reach the final percentages of traffic by corridor.

An important issue in determining trip distribution was the proportion of site-generated traffic that might use the Woodside Lane site driveway instead of the principal entrance on Summer Street. Because this issue was particularly significant to neighbors along Woodside Lane and Summer Street, HSH devoted considerable attention to modeling the possible site traffic that might use each entrance.

A first cut at modeling the trip distribution was taken in July in response to community concerns. In a preliminary analysis undertaken before the final building program was developed, HSH examined the 2003 memorandum *Symmes Hospital Reuse Alternatives Transportation Assessment,* prepared by Vanasse Hangen Brustlin (VHB) for the Symmes Advisory Committee. This report indicated that the traffic split based on prior counts was 90 percent Summer Street/10 percent Hospital Road. This was the basis for establishment of a guideline that required non-residential site traffic for the new development to be below 10 percent of total traffic. HSH 2004 counts showed that the Woodside Lane entrance served 25 percent of A.M. peak-hour traffic, 31 percent of P.M. peak-hour traffic, and 29 percent of daily traffic, although the volumes were far lower than those when the hospital was in full operation.

In terms of access to regional roadways, Woodside Lane is clearly the route of choice to Route 3 (Mystic Street) to and from the north. It is also a possible route to the Mystic Valley Parkway to and from the east, although it is less preferable as a route from the Summer Street side of the site than from the north side. These two corridors together account for about 36 percent of residential trips and 31 percent of work-based trips. For this reason, and in order to minimize non-residential use of Woodside Lane, the Symmes Advisory Committee recommended that medical uses be confined to the "ridge" area of the site closest to Summer Street, and the site plan reflects this arrangement. In the first trip distribution effort, it was thus assumed that a higher proportion of residential traffic would use Woodside Lane than work-based traffic, as follows:

Residential Traffic

Based on an understanding of travel patterns in the area, HSH assumed that all *regional residential* traffic heading to and from points north via Mystic Street (Route 3) would use the Woodside Lane driveway (9.0 percent). HSH also assumed that about 20 percent of the regional residential trips heading to and from the Mystic Valley Parkway would also use the Woodside Lane driveway to access the site (4.3 percent). All *local residential* traffic to and from the site was assumed to access the site in the same general travel patterns as regional traffic, adding another 2.1 percent of the residential trips to the Woodside Lane driveway. In total, it was estimated that about 16.4 percent of all residential traffic would use the Woodside Lane driveway if it were open.

Non-residential Traffic

For *non-residential* use of the Woodside Lane driveway, HSH assumed in the preliminary analysis that only those familiar with the area (i.e., the work-based trips originating in Arlington) would use this driveway. Again, all local traffic to and from the site was assumed to access the site in the same general travel patterns as regional traffic. These assumptions imply that a total of about 5.3 percent of non-residential traffic would use the Woodside Lane driveway if it were open. This is a conservative estimate, in that for much of the work-based traffic originating in Arlington, Summer Street and Hospital Road would actually be the easier and quicker route to the non-residential components of the development

In response to questions about this approach from neighbors, HSH conducted a second round of analysis in order to establish an estimate of "worst case" or maximum expected traffic that might logically use the Woodside Lane entrance. To refine the distribution assumptions, a travel time study was performed to help determine the shortest-time routes between the site and major corridors, including Route 2 and Route 60 westbound and the Mystic Valley Parkway. The routes, shown in **Figure 13,** left from a common point closest to the proposed site of the medical office building on Hospital Road and traveled to common points where drivers could access the Mystic Valley Parkway, Route 2 and Route 60 east and westbound. Travel time runs were conducted during the weeks of August 9 and 16, 2004. Average time results and distances are provided in **Table 17** and **Table 18.**

Figure 13. Travel Time Study Routes

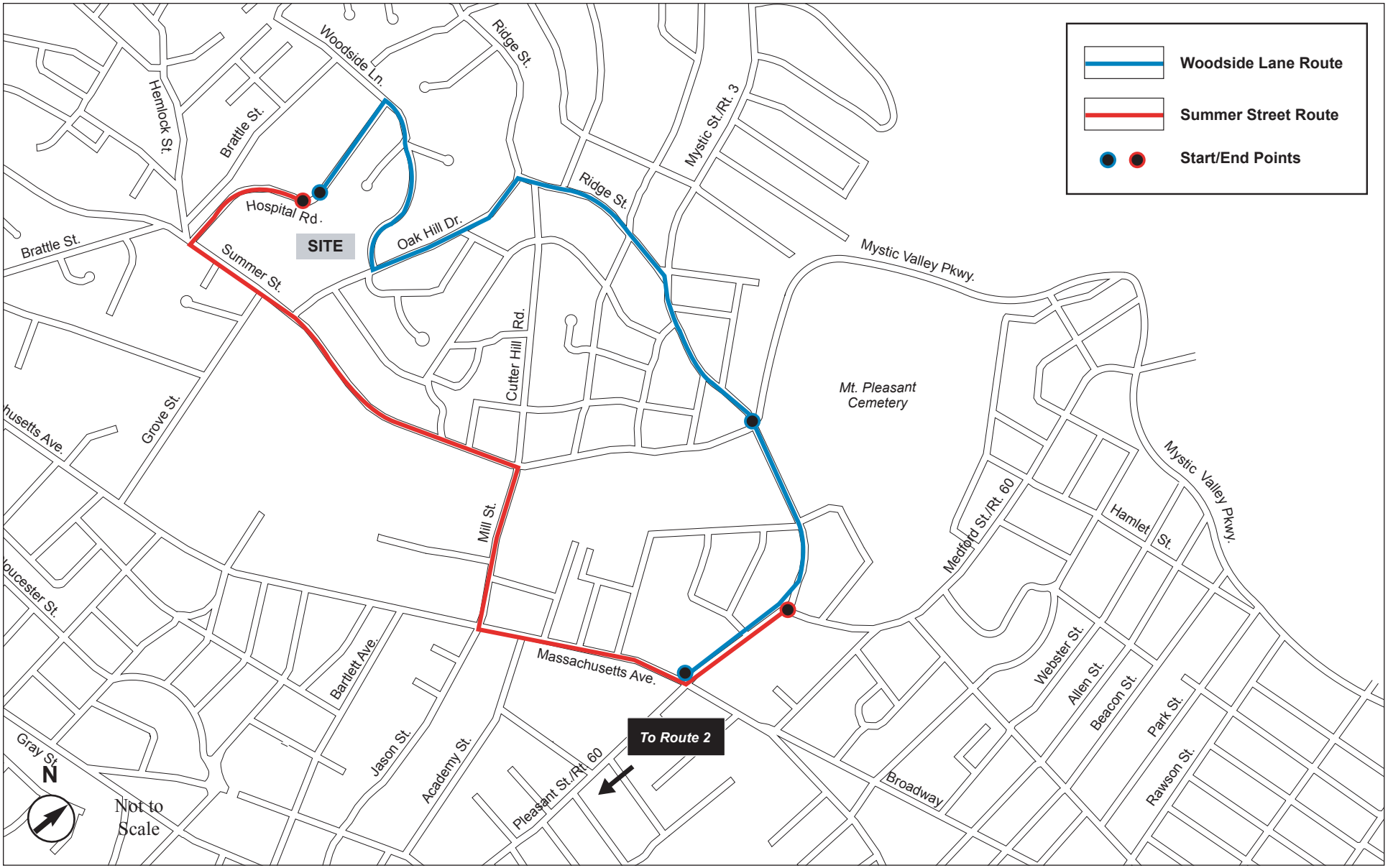


Table 17. Average Travel Times and Distances, A.M. Peak Hour

Route	Via	Approximate Distance (miles)	Average Travel Time (seconds)
Traveling to:			
Mystic Valley Parkway	Summer Street	0.9	+40
	Woodside Lane	1.0	shortest time
Route 2/Route 60 EB/WB	Mill Street	1.0	shortest time
	Woodside Lane	1.3	+213
Traveling from:			
Mystic Valley Parkway	Summer Street	0.9	shortest time
	Woodside Lane	1.0	+15
Route 2/Route 60 EB/WB	Mill Street	1.0	shortest time
	Woodside Lane	1.3	+61

Table 18. Average Travel Times and Distances, P.M. Peak Hour

Route	Via	Approximate Distance (miles)	Average Travel Time (seconds)
Traveling to:			
Mystic Valley Parkway	Summer Street	0.9	+31
	Woodside Lane	1.0	shortest time
Route 2/Route 60 EB/WB	Mill Street	1.0	shortest time
	Woodside Lane	1.3	+33
Traveling from:			
Mystic Valley Parkway	Summer Street	0.9	shortest time
	Woodside Lane	1.0	+13
Route 2/Route 60 EB/WB	Mill Street	1.0	shortest time
	Woodside Lane	1.3	+62

Results of the study indicate that residential drivers may choose to access Mystic Valley Parkway by way of Woodside Lane during the A.M. peak, since this travel time is the shortest. However, this path requires 5 turning maneuvers at intersections. Traveling via Summer Street to the Mystic Valley Parkway only requires 1 left turn out of Hospital Road. This consideration balances a 30- to 40-second shorter trip time. For workers coming to the site in the morning from the Mystic Valley Parkway, Summer Street is a quicker route, but by only 15 seconds. In the evening peak hour, the Woodside Lane route is 31 seconds shorter than the Summer Street route for workers leaving the site, but 13 seconds longer for residents returning home. The transportation analysis therefore assigns half of worker and residential traffic to Mystic Valley Parkway by way of Woodside Lane and the other half to Summer Street, along with all the traffic coming from or going to the Route 3 corridor to the north.

Route 60 east and westbound would be accessed by way of Summer Street, since there is a channelized right-turn lane at Mystic Street and little delay for the right turn. Due to long queues on Mystic Street, it is more effective to use Massachusetts Avenue via Summer Street and Mill Street to access Route 60 and Route 2. The travel time study bears out this assumption, as the Mill Street route to these corridors is always fastest. Based on these assumptions, the final trip distribution for the "worst-case" transportation analysis is shown in **Figure 14** and **Figure 15.**

Figure 14. Trip Distribution, Option 1

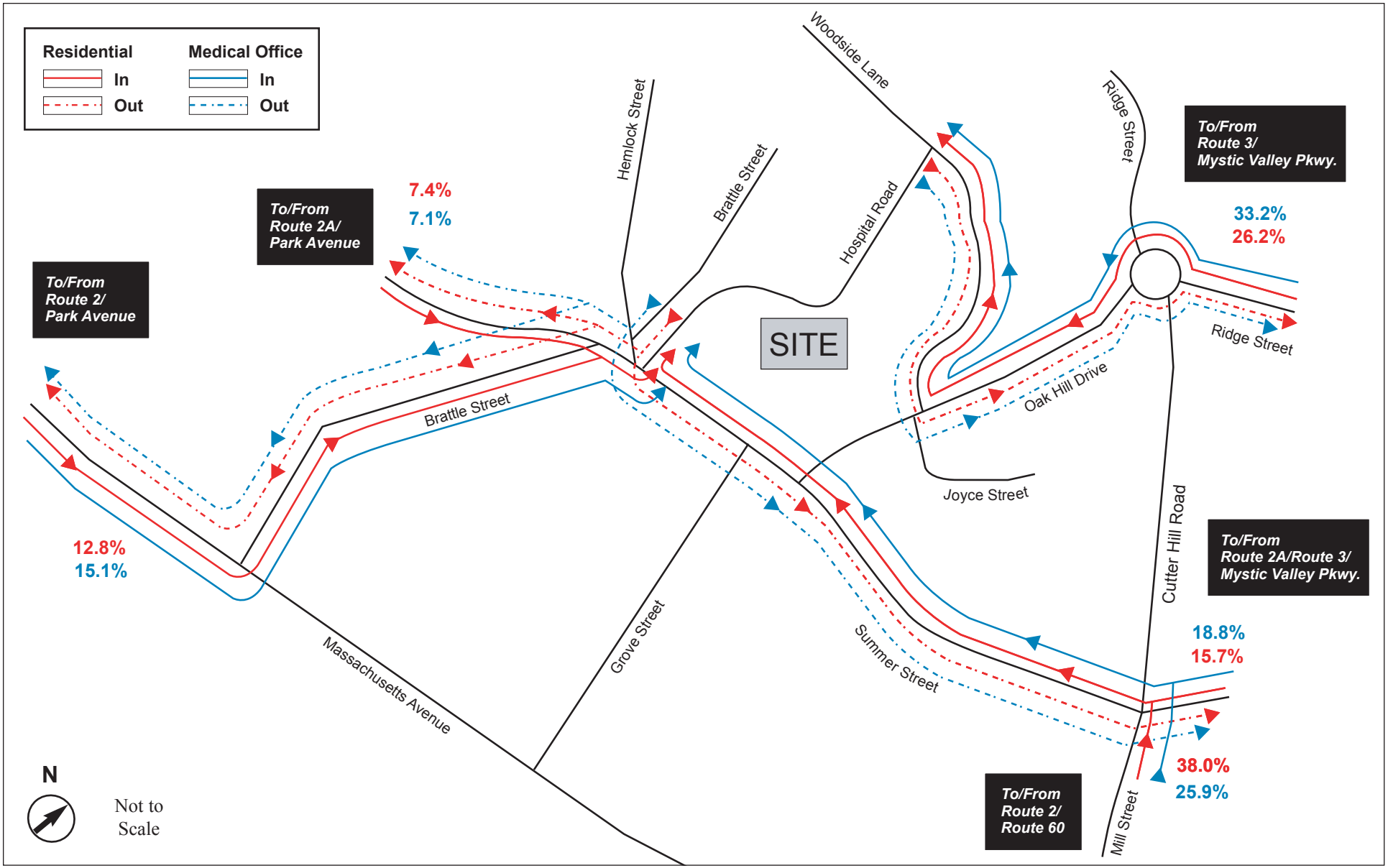
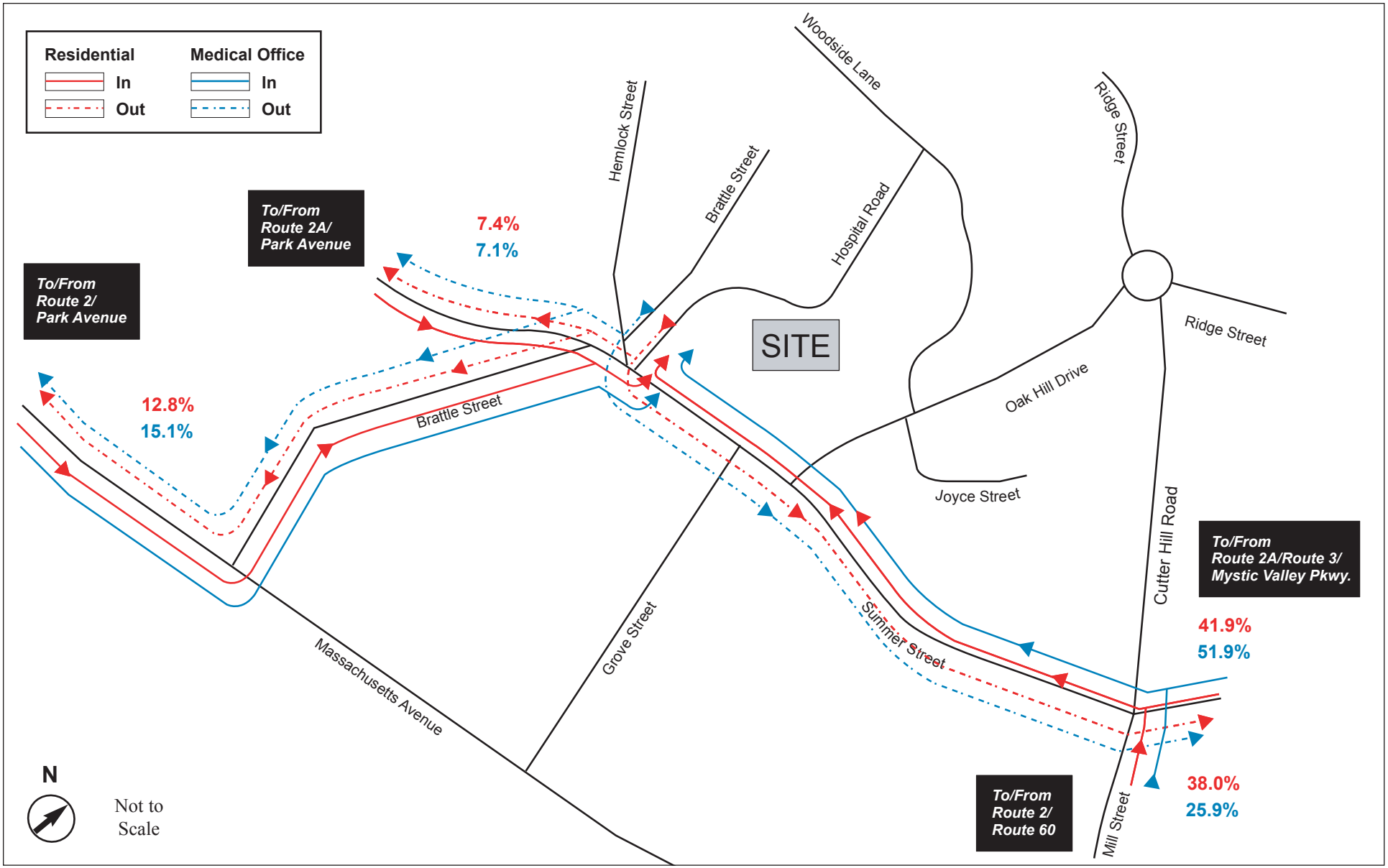


Figure 15. Trip Distribution, Option 2



Build Transportation Impacts

Using the "worst-case" trip distribution assumptions described above, project-generated traffic was assigned to the street network for two access options in response to community concerns. The first assumed that the Woodside Lane driveway remains open as a two-way entrance/exit to the site. The second assumed that the Woodside Lane entrance is closed.

Option 1

The Build Option 1 scenario (**Figure 14,** above) assumes no changes to the site circulation. Traffic may use Woodside Lane and Summer Street to enter and exit the site. Under this scenario, all traffic using Route 3 to/from the north and 50 percent of the trips using the Mystic Valley Parkway were assigned to Woodside Lane; the rest of the trips use Summer Street. As shown in **Figure 14,** Woodside Lane under Option 1 is estimated to carry a maximum of 33.2 percent of medical office traffic and 26.2 percent of residential traffic to and from the site as a worst case.

Option 2

The second scenario, Option 2 **(Figure 15),** reflects the closure of Hospital Road at Woodside Lane. All site traffic would be required to use Summer Street.

Figure 16 and **Figure 17** illustrate the peak-hour project-generated trips for Options 1 and 2 dispersed throughout the study area intersections, based on the distribution presented above. The Build traffic volumes (No-Build plus the project-generated trips) are shown in **Figure 18** and **Figure 19** for Option 1 and **Figure 20** and **Figure 21** for Option 2. As shown in **Figure 18** and **Figure 19,** total traffic added to Woodside Lane beyond the volumes that exist today in Option 1 amounts to 7 entering and 27 exiting in the A.M. peak hour and 31 entering and 18 exiting in the P.M. peak hour. Total volumes on Woodside Lane at full Build will be 20 entering and 28 leaving in the A.M. peak hour and 32 entering and 32 leaving in the P.M. peak hour. On Summer Street, Build volumes are estimated at 44 entering and 76 leaving in the A.M. peak hour and 115 entering and 102 leaving in the P.M. peak hour. As shown, Woodside Lane volumes are actually negative for Option 2, as the assignment reflects the removal of existing trips that now use the Woodside entrance. Summer Street carries all 168 cars in and out in the morning and all 217 cars in and out in the evening.

Intersection capacity and queuing analyses were repeated to predict traffic operations under Build Conditions. For a conservative analysis, existing trips to the site were not subtracted from the street network. Intersection LOS and queuing length estimates at study area locations are shown in **Table 19** and **Table 20** for Option 1.

Figure 16. Project-generated Trips: Option 1, A.M. (P.M.)

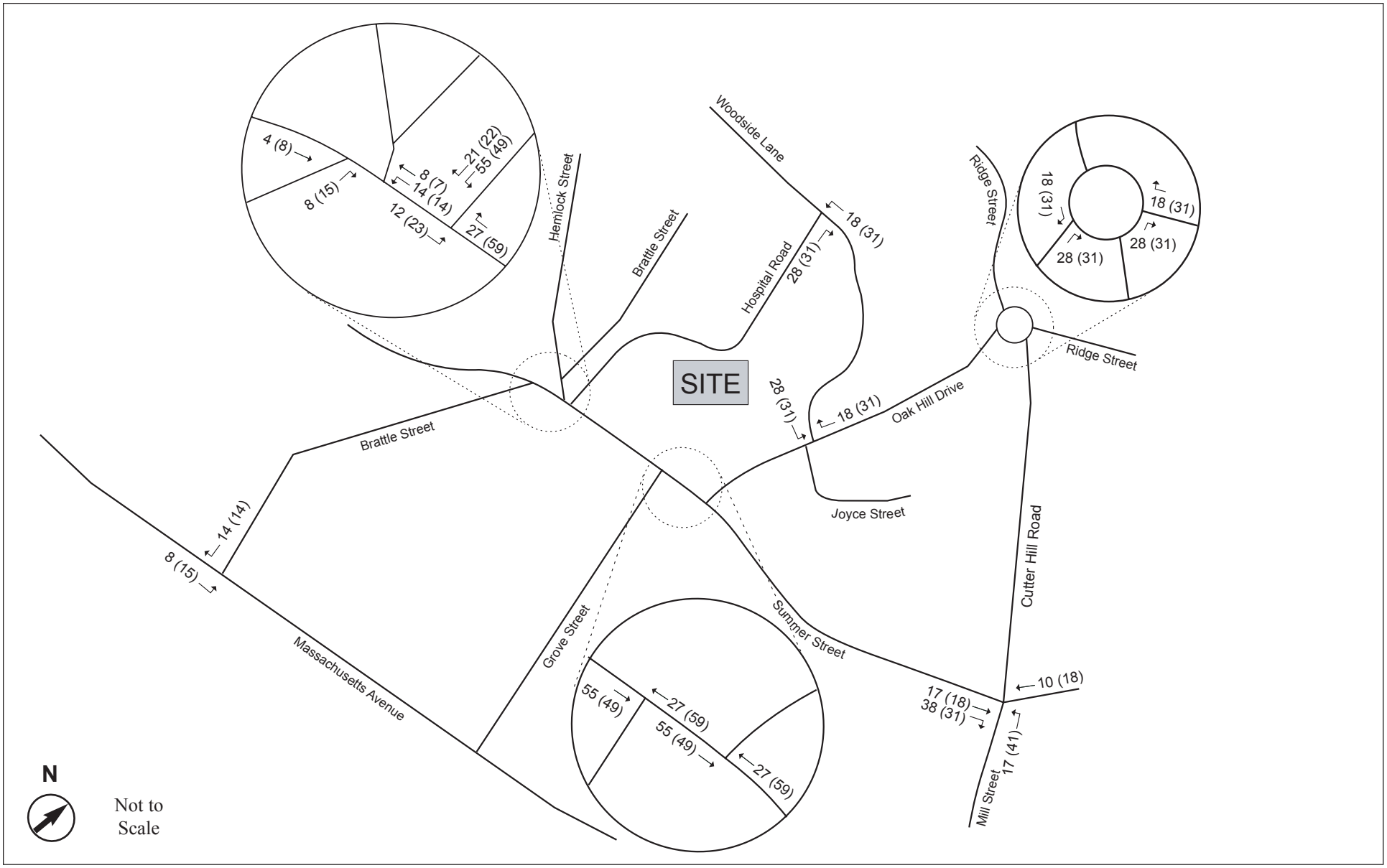


Figure 17. Project-generated Trips: Option 2, A.M. (P.M.)

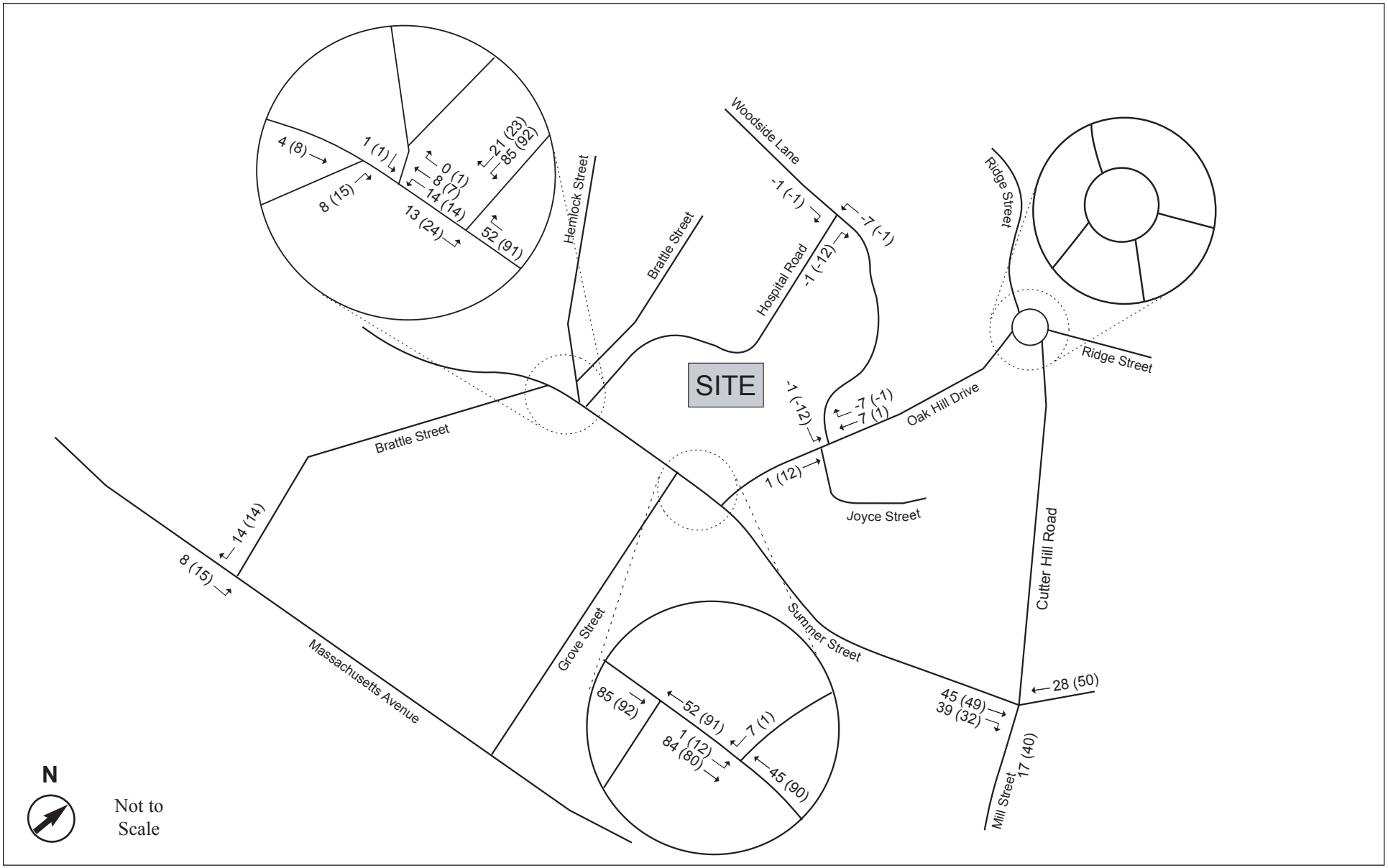


Figure 18. Build Conditions, (2009) Turning Movement Counts: Option 1, A.M. Peak Hour (7:30–8:30 A.M.)

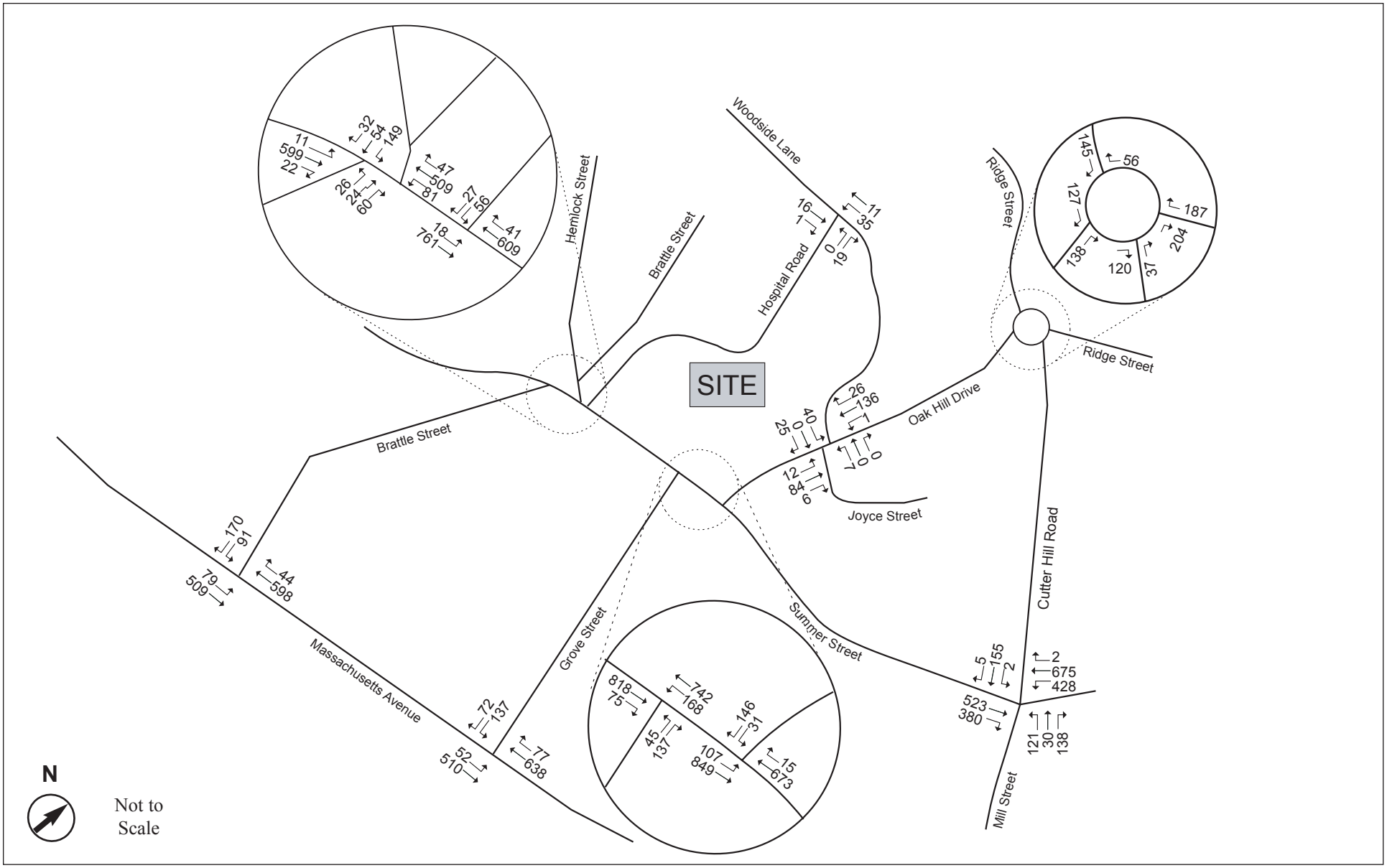


Figure 19. Build Conditions, (2009) Turning Movement Counts: Option 1, P.M. Peak Hour (4:45–5:45 P.M.)

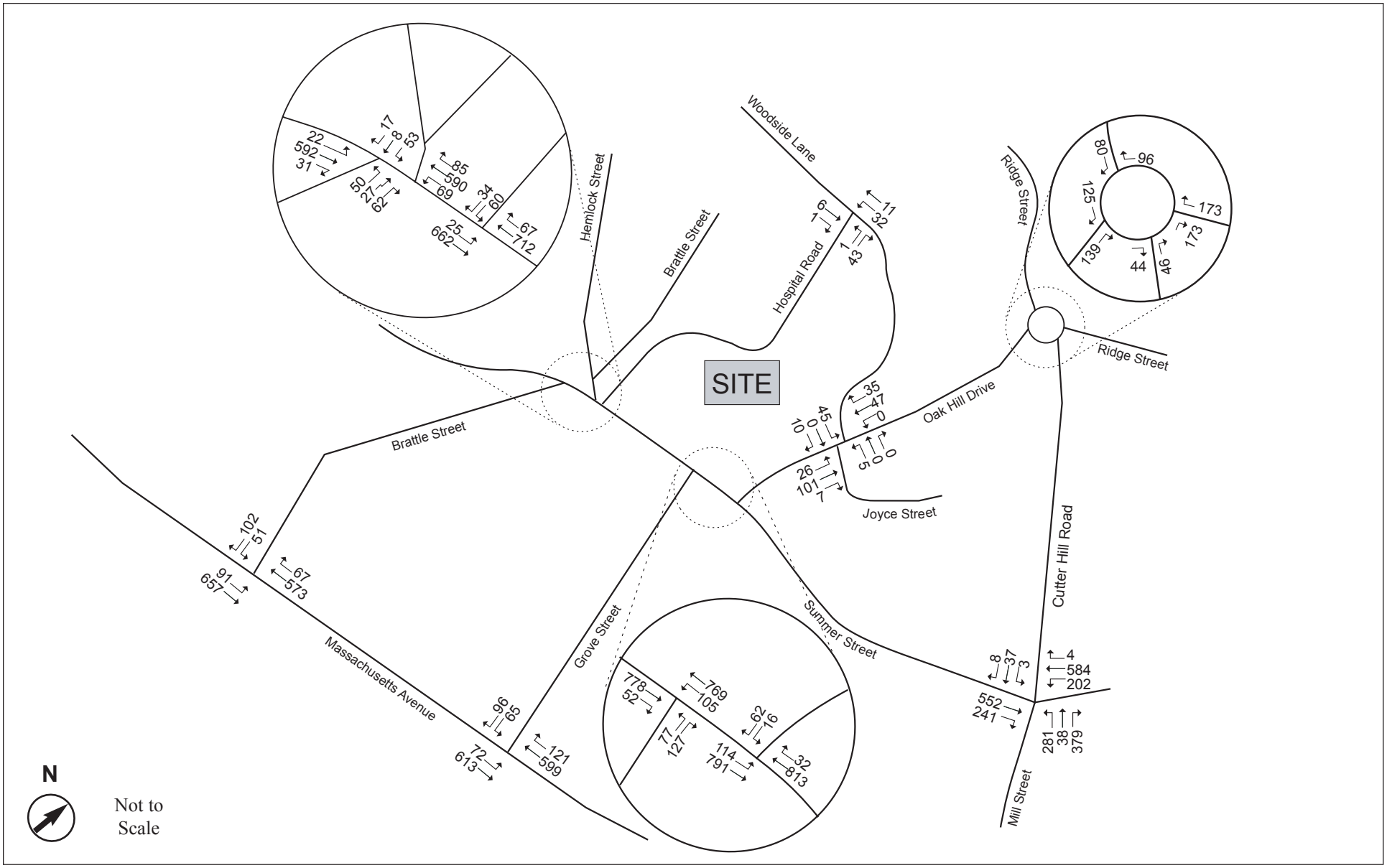


Figure 20. Build Conditions, (2009) Turning Movement Counts: Option 2, A.M. Peak Hour (7:30–8:30 A.M.)

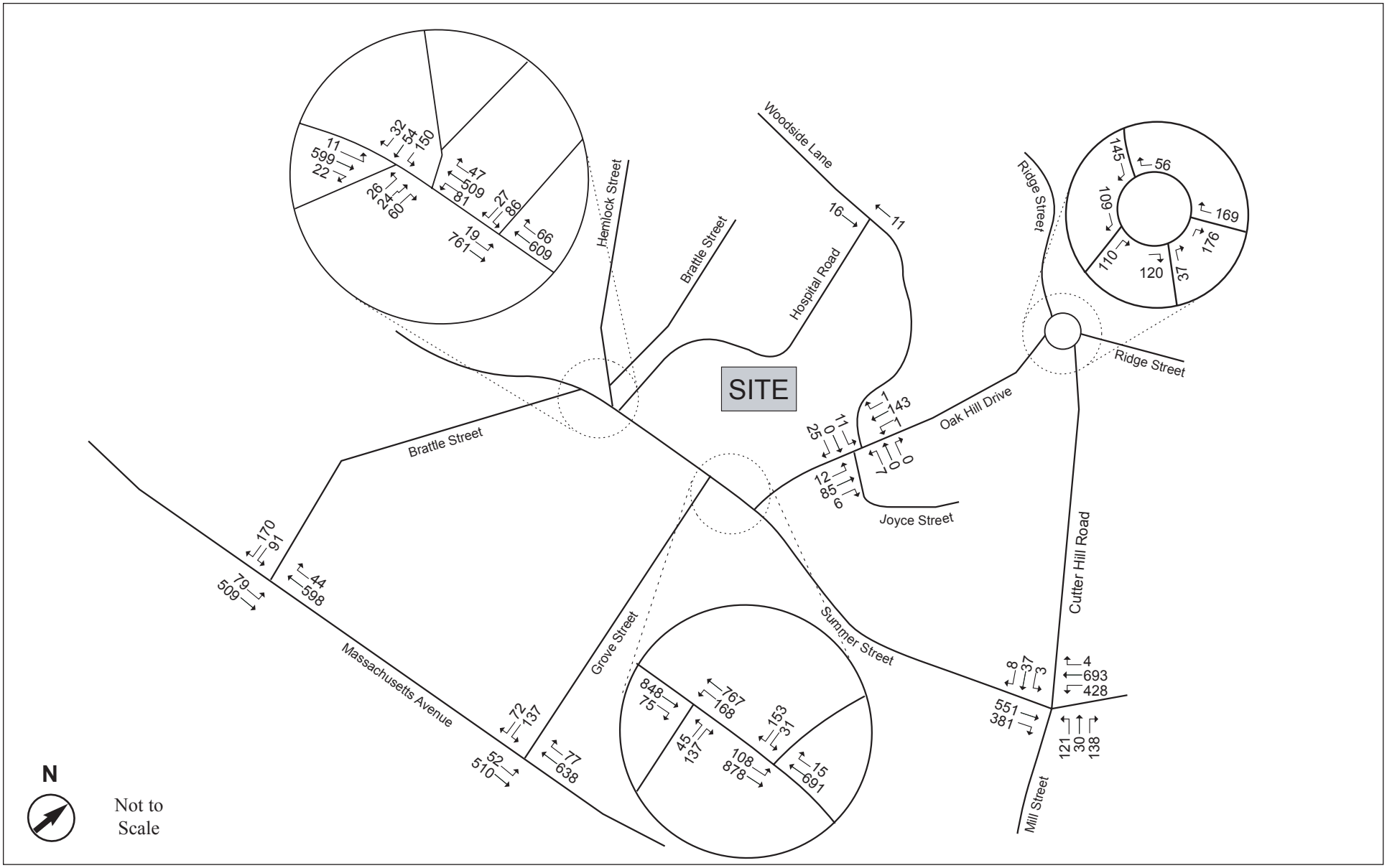


Figure 21. Build Conditions, (2009) Turning Movement Counts: Option 2, P.M. Peak Hour (4:45–5:45 P.M.)

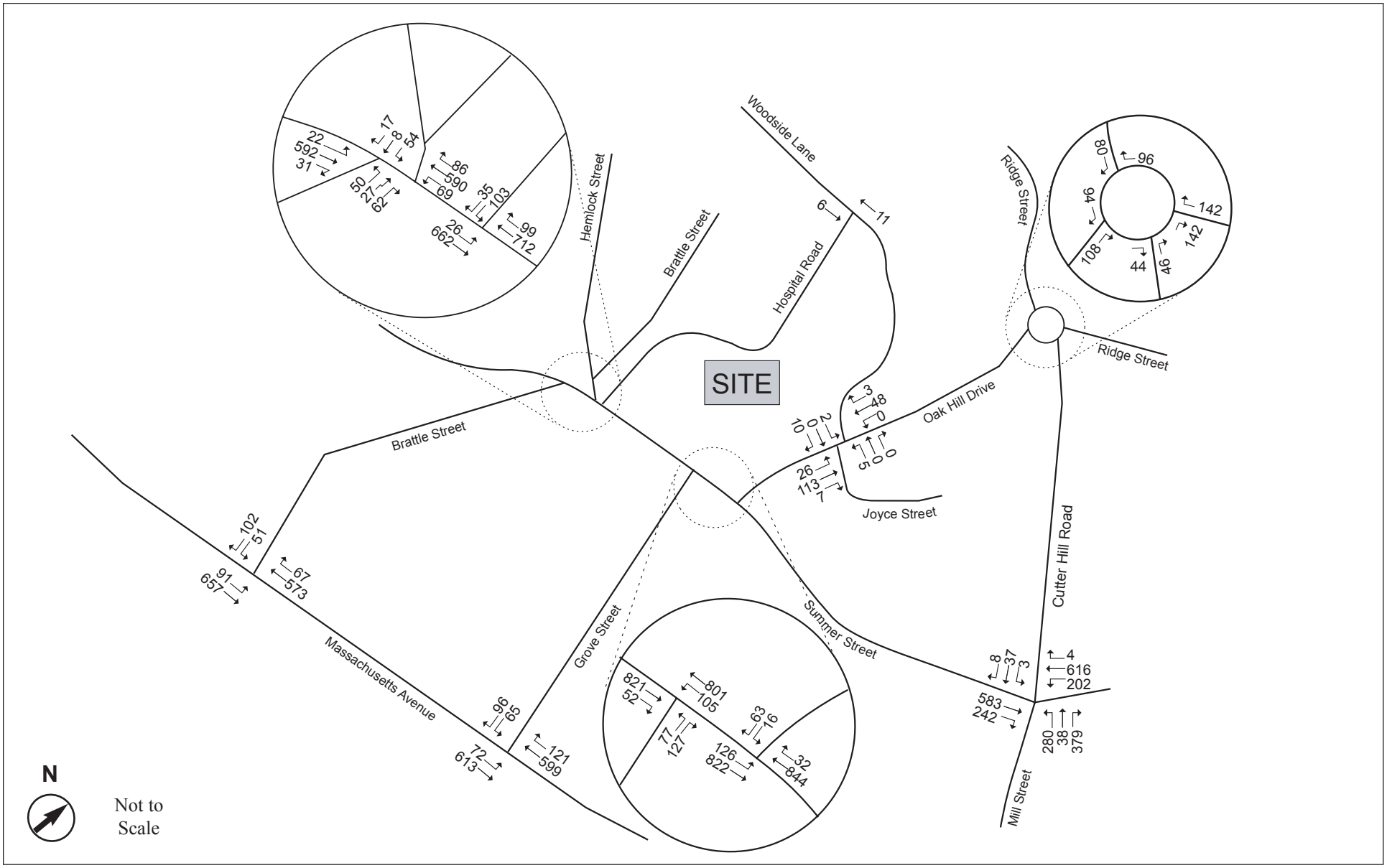


Table 19. Build Conditions Level of Service, Option 1, A.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**C**	**28.4**
Summer Street/Brattle Street/Hemlock Street	**C**	**22.1**
Summer Street/Cutter Hill Road/Mill Street	**D**	**54.2**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	2.3
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Hospital Road		
Summer EB left/thru	A	0.7
Summer WB thru/right	A	0.0
Hospital SB left/right	F	>50.0
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	B	10.6
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	3.7
Summer WB thru/right	A	0.0
Oak Hill SB left/right	F	>50.0
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	B	11.7
Joyce WB left/thru/right	B	11.7
Oak Hill NB left/thru/right	A	1.0
Oak Hill SB left/thru/right	A	0.1
Woodside Lane/Hospital Road		
Woodside EB thru/right	A	0.0
Woodside WB left/thru	A	5.9
Hospital left/right	A	8.6
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	9.9
Ridge WB left/thru/right	B	10.2
Cutter Hill NB left/thru/right	A	8.3
Ridge SB left/thru/right	A	10.0

Table 20. Build Conditions Level of Service, Option 1, P.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**B**	**19.9**
Summer Street/Brattle Street/Hemlock Street	**B**	**18.2**
Summer Street/Cutter Hill Road/Mill Street	**D**	**35.9**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	3.3
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Hospital Road		
Summer EB left/thru	A	0.9
Summer WB thru/right	A	0.0
Hospital SB left/right	F	>50.0
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	A	5.0
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	4.5
Summer WB thru/right	A	0.0
Oak Hill SB left/right	F	>50.0
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	B	11.0
Joyce WB left/thru/right	B	10.9
Oak Hill NB left/thru/right	A	1.6
Oak Hill SB left/thru/right	A	0.0
Woodside Lane/Hospital Road		
Woodside EB thru/right	A	0.0
Woodside WB left/thru	A	5.7
Hospital left/right	A	8.6
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	9.4
Ridge WB left/thru/right	A	9.4
Cutter Hill NB left/thru/right	A	8.3
Ridge SB left/thru/right	A	8.8

In addition to the analysis performed for Option 1, a second analysis was performed that included the proposed mitigation at the Summer Street/Hospital Road intersection, as shown in **Table 21.** The signalization of this intersection is not a difficult task; its close proximity to the Summer Street/ Brattle Street/Hemlock Street intersection allows the two to be tied in and work from the same signal controller. Since the two intersections will work in tandem, they can be phased properly to avoid blocking problems and to ensure the safety of both drivers and pedestrians in and around the intersection.

Table 21. Build Conditions, Option 1 Mitigated— Level of Service, Signalized Intersections

Intersection/Movement	LOS	Delay (sec.)
A.M. Peak Hour		
Massachusetts Avenue/Brattle Street	**C**	**28.4**
Summer Street/Brattle Street/Hemlock Street	**C**	**24.9**
Summer Street/Hospital Road	**C**	**21.4**
Summer Street/Cutter Hill Road/Mill Street	**D**	**54.2**
P.M. Peak Hour		
Massachusetts Avenue/Brattle Street	**B**	**19.9**
Summer Street/Brattle Street/Hemlock Street	**C**	**28.4**
Summer Street/Hospital Road	**C**	**22.9**
Summer Street/Cutter Hill Road/Mill Street	**D**	**35.9**

The proposed phasing is similar to what is being proposed by MassHighway as a part of their improvements at the intersection, but it does have some distinct differences. The protected left-turn phase for westbound Summer Street was dropped because the demand for this phase is relatively low. The proposed geometry will also allow vehicles waiting to turn left onto Brattle Street to queue in the middle of the intersection without blocking other westbound traffic.

The progression of the phasing will prevent traffic entering or exiting Hospital Road from ever being blocked by traffic queued on Summer Street. Vehicles on the southbound approach will have separate left-turn and right-turn lanes. Depending on demand, left-turns from Hospital Road will operate either with the right-turns or in the exclusive pedestrian phase at the Summer/Brattle/Hemlock intersection.

Option 2 results are shown in **Table 22** and **Table 23.** Because all traffic going to and from the site in Option 2 would be coming from Summer Street, it was assumed that Option 2 would only occur along with the signalization of that intersection. Detailed Synchro reports for Build Conditions are provided in **Appendix C.**

Table 22. Build Conditions Level of Service, Option 2, A.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**C**	**28.4**
Summer Street/Brattle Street/Hemlock Street	**C**	**25.9**
Summer Street/Hospital Road	**C**	**27.9**
Summer Street/Cutter Hill Road/Mill Street	**D**	**54.9**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	2.3
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	B	10.8
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	3.9
Summer WB thru/right	A	0.0
Oak Hill SB left/right	F	>50.0
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	B	10.1
Joyce WB left/thru/right	B	11.6
Oak Hill NB left/thru/right	A	1.0
Oak Hill SB left/thru/right	A	0.1
Woodside Lane/Hospital Road *		
Woodside EB thru/right		
Woodside WB left/thru		
Hospital left/right		
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	9.3
Ridge WB left/thru/right	A	9.7
Cutter Hill NB left/thru/right	A	8.1
Ridge SB left/thru/right	A	9.7

* Hospital Road is closed at Woodside Lane.

Table 23. Build Conditions Level of Service, Option 2, P.M. Peak Hour

Intersection/Movement	LOS	Delay (sec.)
Signalized Intersections		
Massachusetts Avenue/Brattle Street	**B**	**19.9**
Summer Street/Brattle Street/Hemlock Street	**C**	**28.3**
Summer Street/Hospital Road	**C**	**29.9**
Summer Street/Cutter Hill Road/Mill Street	**D**	**36.9**
Unsignalized Intersections		
Massachusetts Avenue/Grove Street		
Massachusetts EB left/thru	A	3.3
Massachusetts WB thru/right	A	0.0
Grove SB left/right	F	>50.0
Summer Street/Grove Street		
Summer EB thru/right	A	0.0
Summer WB left/thru	A	5.5
Grove NB left/right	F	>50.0
Summer Street/Oak Hill Drive		
Summer EB left/thru	A	5.3
Summer WB thru/right	A	0.0
Oak Hill SB left/right	F	>50.0
Woodside Lane/Oak Hill Drive		
Woodside EB left/thru/right	B	9.0
Joyce WB left/thru/right	B	10.9
Oak Hill NB left/thru/right	A	1.5
Oak Hill SB left/thru/right	A	0.0
Woodside Lane/Hospital Road *		
Woodside EB thru/right		
Woodside WB left/thru		
Hospital left/right		
Cutter Hill Road/Oak Hill Drive/Ridge Street		
Oak Hill EB left/thru/right	A	8.8
Ridge WB left/thru/right	A	8.7
Cutter Hill NB left/thru/right	A	8.0
Ridge SB left/thru/right	A	8.5

* Hospital Road is closed at Woodside Lane.

In general, the addition of the Build trips to the existing traffic network has little impact on intersection operation. The drop in overall operation at Summer Street/Cutter Hill Road/Mill Street from LOS C to LOS D during the evening peak hour is an increase in delay of only 4.5 seconds. The signalization of Hospital Road causes a decrease in service from LOS B under No-Build Conditions to LOS C in the evening peak hour at Summer Street/Hemlock Street/Brattle Street, although LOS C is still a good operational level. This drop in overall level of service is offset by improving the Hospital Road intersection from LOS F when it operates with no traffic signal to LOS C. Further, there is no longer any blocking of the Hospital Road approach by queues backing up from the Summer/Hemlock/Brattle intersection. The 95th percentile queues on Summer Street remain long but dissipate within one cycle length due to a long green indication. Average driving delay is under 30 seconds in both the morning and the evening.

Public Transportation

With the development, the MBTA bus stop will be maintained on-site. A new bus shelter will be installed. The site itself is expected to generate 20 transit trips during the A.M. peak and 27 trips during the P.M. peak. The buses have sufficient capacity to accommodate these riders. The MBTA has indicated a willingness to bring both inbound and outbound service to the site, should ridership increase sufficiently as a result of the project.

Parking

Parking will be provided on site for 626 vehicles, an increase of 360 spaces, in a combination of surface and garage spaces. Residents will be supplied with approximately 450 spaces, or approximately 1.8 spaces per unit, depending on the need. The remaining spaces will be provided to visitors at the park and the medical office component.

Pedestrians

A new sidewalk will be constructed on Hospital Road between Summer Street. At Summer Street/Hemlock Street/Brattle Street, pedestrian safety will be improved due to a change in phasing that is being proposed as a part of the signalization of the Hospital Road intersection. Pedestrians will be given an exclusive phase upon actuation of one of the pushbuttons, preventing possible accidents between turning vehicles and pedestrians in crosswalks. The site plan appears above, in **Figure 12.**

Compliance with Symmes Advisory Committee Guidelines

In line with the recommendations of the Symmes Advisory Committee, the proponent has met planning and design requirements to minimize transportation impacts on surrounding neighborhoods. Above all, the Symmes Advisory Committee recommendations on traffic, access, and parking were used as guidelines for project design, as follows:

1. ***REQUIREMENT: A comprehensive traffic impact study will be required for any proposed development, and proponents will be required to complete identified mitigation measures.***

   The proponent has submitted this traffic impact study for consideration prior to the Town Meeting vote on the proposed zoning changes as requested by the community. Mitigation measures are identified in this report. Each mitigation measure and recommended action will be detailed and reviewed during the Special Permit process.

2. ***REQUIREMENT: Development shall be limited to the total number of peak-hour vehicle trips that were generated when the hospital was in full operation (375 vehicles during the evening peak hour).***

   Total P.M. peak-hour vehicle trips estimated for the project at full Build are 263 trips: 125 entering and 138 leaving, or 215 net new trips (113 entering and 102 leaving) above those generated by the Lahey Clinic operation on the site today. Total P.M. peak-hour trips are 30 percent lower than specified by the Advisory Committee, and total daily trips are 40 percent lower than those generated by the hospital at full operation.

3. ***REQUIREMENT: Primary access to the site shall be from Summer Street.***

   Primary access to the site remains on Summer Street.

4. ***REQUIREMENT: Truck access shall be limited to the Summer Street entrance.***

   The proponent agrees with this restriction and will be sure it is applied both for the construction period and for final Build traffic.

5. ***REQUIREMENT: Woodside Lane shall remain a low-volume local roadway. No proposal should suggest that more than 10 percent of non-residential peak-hour site traffic would utilize Woodside Lane. Proposals suggesting programs to minimize use of Woodside Lane, including installation of a traffic monitoring program, are encouraged.***

   HSH has analyzed several trip distribution scenarios for the Woodside Lane driveway, based on U.S. Census Journey to Work data for home-based and employment-based trips in the Symmes census tract. On this basis, the initial analysis assumed that 16 percent of residential traffic and 5 percent of non-residential traffic would use Woodside Lane. In response to community input, the analysis in this report is based on a "worst-case" assumption that a maximum of 26 percent of residential traffic and 33 percent of non-residential traffic would use Woodside Lane. Given this "worst case" assumption, the proposed project will add 28 entering trips and 18 exiting trips to Woodside Lane in the morning peak hour beyond the traffic currently using this entrance from the Lahey Clinic operation, and 32 entering and 31 exiting trips beyond current volumes in the afternoon peak hour, as follows:

	Existing		Proposed		Change	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Entering	8	1	36	33	+28	+32
Leaving	1	13	19	44	+18	+31

   The traffic study analyzed two options: one with the Woodside Lane driveway open and one with Woodside Lane closed. The study showed that project traffic can be accommodated in a satisfactory manner under either alternative, but that Summer Street intersections experience increased delay if Woodside Lane is closed. The proponent is willing to work with the Town to implement any scheme that is determined to be in the best interests of local and area traffic, including:

   - Location of medical office building. The site plan already locates the medical office building on the Summer Street side of the property to minimize use of Woodside Lane by non-residential traffic, as recommended by the committee. Use of Summer Street can be reinforced through materials giving directions to patients, employee newsletters, etc.

   - Closing the Woodside Lane entrance. Hospital Road is a private way, so this is within control of the proponent. Arguments both for and against this closure have been heard in community meetings.

   - Leaving the Woodside Lane entrance open. This option is opposed by Woodside Lane residents, but supported by residents on the Summer Street side of the project. Arguments on both sides have been heard in community meetings.

- Making the Woodside Lane entrance one-way in, combined with a one-way circulation around the site that discourages cut-through traffic. This solution is recommended as a compromise solution that reduces peak traffic on Woodside Lane while lessening the impacts of the closure on Summer Street intersections.

- With either option, signing Hospital Road north of the Medical Office Building as "Resident and MBTA Bus Access Only."

- With either option, working with the Town and residents along Woodside Lane and Oak Hill Drive to develop measures to improve safety and reduce vehicle speeds at the Woodside/Oak Hill intersection, including signage, stop controls, variable message boards to alert drivers of speed, intersection realignment, roadway narrowing and other traffic calming measures.

- Should the Woodside Lane entrance remain open, monitoring traffic on a a regular basis, with reports to the Selectmen's Transportation Advisory Committee.

Implementation of one or more of these measures will insure that, following implementation of the project, non-residential traffic volumes on Woodside Lane will remain below 10% of total non-residential site traffic, and that it will retain its character as a local street.

7. ***PREFERENCE: Redesign or relocation of the intersection of Hospital Road and Summer Street is preferred in order to enhance the operational efficiency of the intersection.***

   The proponent has developed a scheme for signalizing Hospital Road and Summer Street and integrating its operation with the Summer/Hemlock/Brattle intersection in conjunction with the MassHighway improvement project for Summer Street between Hospital Road and the Lexington town line to the west. This intersection redesign scheme will improve operations, reduce queuing across the Hospital Road approach, and improve pedestrian safety.

8. ***REQUIREMENT: Traffic mitigation measures should take into consideration the intersections of Summer Street with Oak Hill Drive, Grove Street, Hospital Road and Brattle Street/Hemlock Street.***

   Summer Street/Hemlock Street/Brattle Street and Summer Street/Hospital Road are discussed above. At Oak Hill Drive and Grove Street intersections with Summer Street, the VHB study recommended possible signalization. The proponent has discussed this possibility with the community, mentioning that adding signals at these locations may attract more through traffic to these streets. Further detailed traffic counting and analysis is necessary to determine whether these locations meet signal warrants, which is not appropriate at this stage of the approval process. Once these analyses are complete, the proponent will develop appropriate pedestrian safety and traffic calming measures at these locations if signals are not appropriate.

9. ***REQUIREMENT: Parking shall be provided on site in accordance with the Town of Arlington zoning requirements with no discretionary reduction.***

   The parking proposed meets the Town's requirements and no reduction is proposed. Residents will be supplied with about 450 spaces for 275 units, a ratio of 1.6 spaces per unit. The Town of Arlington recommends 2.0 spaces/unit for luxury housing, 1.5 spaces/unit for market rate housing, and 1.0 spaces/unit for affordable housing. The 40,000 sf medical office building will have 165 spaces, a ratio of 4.1 spaces per 1,000 sf. The Town of Arlington recommends 3.3 spaces per 1,000 sf. The park will have 11 spaces for visitors.

10. ***PREFERENCE: Shared parking among on-site uses is encouraged as long as all parking can be accommodated on-site during peak hours without spillover to facilities off-site.***

    Shared parking has been taken into consideration between the medical facilities and the nearby residential building. All parking will be accommodated on-site. Surface lot spaces are at a minimum, and most parking is in structures, reducing paved areas on site and screening the parking from view.

11. ***REQUIREMENT: An on-site pedestrian network is required, with connections to public points of access. Sidewalks along the Summer Street frontage are required.***

    The project will provide pedestrian access up Hospital Road and extend the Summer Street sidewalk along the property toward Oak Hill Drive. There will be an additional pedestrian pathway through the wooded area behind the Nurses Building to connect Hospital Road and Summer Street, enhancing connections to the Minuteman bike path and local schools.

12. ***PREFERENCE: Off-site improvements that provide pedestrian connections to schools and the Minuteman Bikeway are encouraged.***

    The proponent will work with the Town on pedestrian improvements to intersections in the vicinity of the site, including improved crosswalks and sidewalks and various types of signing to alert motorists to the presence of school children and to identify routes to the bike path.

13. ***REQUIREMENT: Public transportation to the site shall be accommodated and promoted. The proponents shall work with the MBTA to designate appropriate locations for bus stops to service the site.***

    The site plan provides for MBTA buses to enter the site and turn around through the residential area. Initial contacts with the MBTA have indicated that they will consider offering both inbound and outbound service up the hill and through the site if ridership is sufficient with the new building program. The proposed signal at Hospital Road and Summer Street should make it easier for MBTA buses to enter and leave the site from both directions on Summer Street.

Mitigation Summary

The conclusions of this traffic study are that the impacts of the proposed redevelopment of the site can be accommodated with minimal impacts to neighborhood streets, as the traffic generated by the proposed development represents only 60 percent of daily traffic generated when the hospital was in full operation and only 70 percent of peak-hour traffic volumes.

Understanding that Symmes neighbors and community groups are nevertheless concerned about added traffic, the proponent commits to the following mitigation measures:

Traffic

- Redesign of the Summer Street/Brattle Street/Hemlock Road intersection is proposed to accommodate a new signalized approach at Hospital Road, to be constructed in conjunction with the MassHighway improvement project for Summer Street. This solution will accommodate most of the development vehicular traffic with acceptable operations on Summer Street and side streets both at Hospital Road and at Brattle Street/Hemlock Street, while improving pedestrian safety. Because the Hospital Road signal will be coordinated with the Hemlock Street/Brattle Street signal, no queues will back up at Hospital Road. In addition, Summer Street queues are expected to dissipate within one signal cycle due to the relatively long green time accorded the Summer Street approaches.

- As stated above, making Woodside Lane one-way entering the site is recommended as a compromise solution that reduces potential traffic on Woodside Lane without unduly burdening Summer Street intersections. This solution can be combined with instituting a one-way circulation scheme on Hospital Road within the northern part of the site to discourage traffic from using Woodside Lane as a "cut-through." Signing within the site will also be employed to limit access north of the medical building to residents and MBTA buses only.

- Should the Woodside Lane entrance remain open either two-way or one-way, the proponent will monitor traffic at the Woodside Lane driveway on a regular basis and report the results to the Selectmen's Transportation Advisory Committee.

- Readjustment of signal timings is recommended along Summer Street at Cutter Hill Road and Mill Street in coordination with the MassHighway Summer Street improvement project implementation to the west will be investigated as part of the Special Permit process.

- Readjustment of signal timings at the Massachusetts Avenue/Brattle Street intersection will also be investigated as part of the Special Permit process.

- In the Special Permit approval process, safety improvements and speed reduction measures at the Woodside Lane/Oak Hill Drive intersection will be investigated. Community groups have suggested a four-way stop at that location, but initial analysis shows that this may not be a safe solution due to the fact that the Woodside Lane approach is both on a curve and downhill as it enters the intersection, increasing the likelihood of rear end collisions. The proponent will work with the Town and neighbors to develop a safe traffic calming solution.

- Signal warrant analysis will be performed to see if signalization is called for at the Summer Street/Grove Street and Summer Street/Oak Hill Drive intersections. If warrants are not met, or if signals are not preferred by community stakeholders, other traffic calming/pedestrian safety measures such as signing, crosswalk improvements, sidewalk bulbouts at corners, etc., will be investigated.

Public Transportation

- The site roadways will be designed to accommodate MBTA buses.

- The proponent will work with the MBTA to increase service to the site, including bringing both inbound and outbound buses up the hill into the site.

- Tenants of the medical office building will be encouraged to employ transportation demand management measures such as on-site transit pass sales, partial subsidies of transit passes, promotion of transit and ridesharing in employee newsletters and the project website, vanpool and carpool incentives, and “guaranteed ride home” for transit riders in order to reduce commuter automobile trips.

Pedestrians and Bicycles

- New sidewalks will be provided on Hospital Road and the Summer Street frontage of the property.

- A new pedestrian pathway will be created from Hospital Road to Summer Street through the woods along the path of the utility easement to enhance access to the Minuteman Bike Path and Summer Street.

- Pedestrian safety improvements will be investigated at nearby intersections that might be affected by school district changes.

Overall, the proponent will continue working with the community and the Town to develop a final mitigation package that will minimize any possible traffic impacts of the project as the Special Permit process continues.

Appendix A. ATR Counts

Appendix B. MassHighway Accident Data

Appendix C. Synchro Reports

Appendix D. Trip Generation Data

Appendix E. Trip Distribution Methodology

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